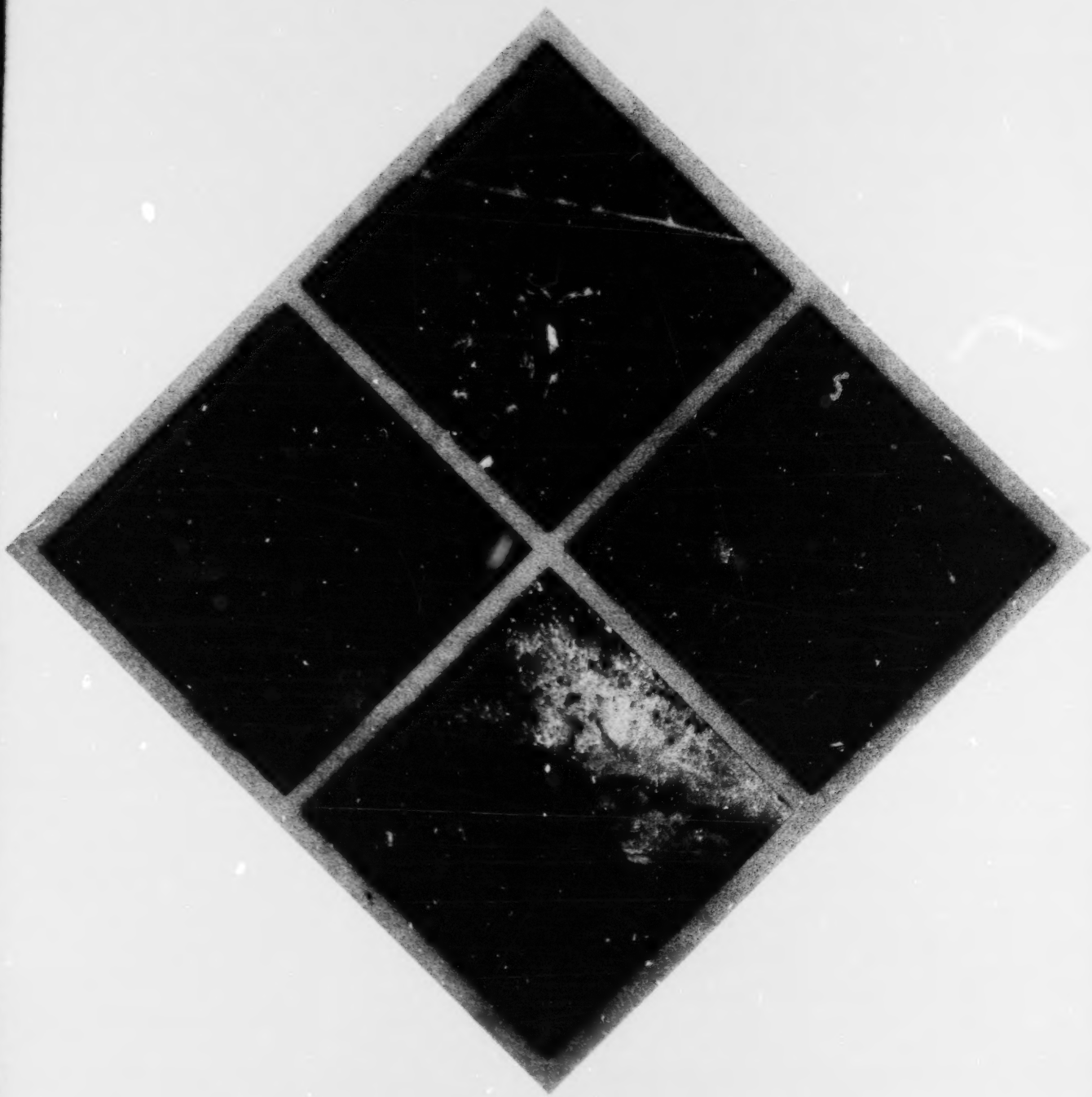
Economics Information

REPT. NO. 84-05

Ontario

Survey Of Pesticide Use In Ontario, 1983



ECONOMICS AND POLICY
COORDINATION BRANCH

ONTARIO MINISTRY OF AGRICULTURE AND FOOD
LEGISLATIVE BUILDINGS, TORONTO, ONTARIO, M7A 1B6

85-4631/

Cover photographs:

Lesser peach tree borer and oblique-banded leaf roller - Courtesy Agriculture Canada Research Station, Vineland Station, Ontario.

Pigweed - Courtesy Agriculture Canada Research Station, Harrow, Ontario.

ECONOMICS INFORMATION
REPORT No. 84-05

SURVEY OF PESTICIDE USE IN ONTARIO, 1983
Estimates of Pesticides Used on Field Crops, Fruits, Vegetables, and in Roadside Weed Control

by

Bill McGee

Economics and Policy Coordination Branch
Ontario Ministry of Agriculture and Food
Legislative Buildings, Queen's Park
Toronto, Ontario
M7A 1B6
September 1984

ISBN 0-7743-9959-7

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	iv
INTRODUCTION	1
SURVEY OF PESTICIDE USE ON FIELD CROPS	
Sample Selection and Mailout	1
Editing	3
Expanding the Sample Data	3
SURVEY OF PESTICIDE USE ON FRUITS AND VEGETABLES	
Sample Selection and Mailout	5
Editing	5
Expanding the Sample Data	6
SURVEY OF PESTICIDE USE IN ROADSIDE SPRAYING	
Data Collection	6
Estimation	6
SUMMARY OF RESULTS	
Presentation	7
Highlights	8
Provincial Level	8
County Level	10
River Basin Level	10
APPENDICES	
I Examples of Methodology Used in the Estimation of Pesticide Use at the County and River Basin Levels - Field Crops	12
II Area Treated and Total Quantities of Specific Pesticide Active Ingredients Used on Field Crops, Ontario, 1983	14
III Quantities of Active Ingredients of Each Type of Pesticide Used on Field Crops in 1983, by County and District, Ontario	15
IV Quantities of Active Ingredients of Each Type of Pesticide Used on Field Crops in the Various Ontario Drainage Basins of the Great Lakes, 1983	16
V Quantities of Specific Pesticide Active Ingredients Used on Field Crops in Four Major Ontario Drainage Basins, 1983	17
VI Quantities of Pesticide Active Ingredients of Each Type of Pesticide Used on Fruit Varieties in Ontario, 1983	20
VII Quantities of Pesticide Active Ingredients of Each Type of Pesticide Used on Vegetable Varieties in Ontario, 1983	20
VIII Quantities of Specific Pesticide Active Ingredients Used on All Fruit in Ontario, 1983	21
IX Quantities of Specific Pesticide Active Ingredients Used on All Vegetables in Ontario, 1983	22

TABLE OF CONTENTS

APPENDICES (cont'd)

X Quantities of Active Ingredients of Each Type of Pesticide Used on Fruit and Vegetables in 1983, by County and District, Ontario 23

XI Quantities of Active Ingredients of Each Type of Pesticide Used on Fruit in the Various Ontario Drainage Basins of the Great Lakes, 1983 24

XII Quantities of Active Ingredients of Each Type of Pesticide Used on Vegetables in the Various Ontario Drainage Basins of the Great Lakes, 1983 24

XIII Quantities of Active Ingredients of Herbicides Used in Roadside Weed Control in 1983, by County and District, Ontario 25

XIV Quantities of Active Ingredients of Herbicides Used in Roadside Weed Control in the Various Ontario Drainage Basins of the Great Lakes, 1983 25

XV Area Grown and Sprayed, and Quantities of Active Ingredients of Pesticides Used on Field Crops, Fruits, Vegetables, and Roadsides in Ontario, 1983 26

XVI Quantities of Specific Pesticide Active Ingredients Used on All Field Crops, Fruits, Vegetables and Roadsides in Ontario, 1983 26

XVII Quantities of Active Ingredients of Each Type of Pesticide Used on All Field Crops, Fruits, Vegetables and Roadside, by County and District, Ontario, 1983 27

XVIII Quantities of Active Ingredients of Each Type of Pesticide Used on All Field Crops, Fruits, Vegetables, and Roadsides in the Various Ontario Drainage Basins of the Great Lakes, 1983 28

XIX List of Common (Chemical) and Trade Names 29

FIGURE

1. River Basins Draining into the Great Lakes, Ontario, 1983 18
2. Agricultural Use of Triazine Herbicides in Ontario, 1983 31
3. Agricultural and Roadside Use of Phenoxy Herbicides in Ontario, 1983 32
4. Agricultural Use of Herbicides Other than Triazine or Phenoxy in Ontario, 1983 33
5. Agricultural Use of Fungicides in Ontario, 1983 34
6. Agricultural Use of Insecticides in Ontario, 1983 35
7. Agricultural Use of Nematocides in Ontario, 1983 36
8. Agricultural Use of Growth Regulators in Ontario, 1983 37
9. Map of Ontario Showing Counties and Districts 38

REFERENCES 39

ACKNOWLEDGMENTS

This report could not have been produced without the valuable assistance of many persons involved in the agricultural industry in Ontario. The contributions of the following individuals are gratefully acknowledged.

Dr. R. Frank, Agricultural Laboratory Services Branch, Ontario Ministry of Agriculture and Food (OMAF), Guelph, was responsible for the hand editing and telephone follow-up of the field crop segment of the survey, compilation of the directory of pesticide chemical and trade names (Appendix XIX), and review of the manuscript at various stages of preparation.

W. Roberts, Plant Industry Branch, OMAF, Vineland Station, supervised the fruit and vegetable segment of the survey including sample selection, mailout, hand editing, telephone follow-up, and preparation of sample tabulations; and also reviewed the manuscript.

D. McLaren, Plant Industry Branch, OMAF, Guelph, provided the tabulations for herbicide use on county and township roadsides.

N. Roller, Economics and Policy Coordination Branch, OMAF, Toronto, contributed numerous helpful suggestions during the course of the survey and preparation of this report; and designed the river basin boundaries used in the study.

A. Hays, Capital Improvements Branch, OMAF, Toronto, prepared the map illustrating the various drainage basins (Figure 1).

Dr. J. Hall, Department of Geography, Wilfred Laurier University, Waterloo, generated the maps depicting the intensity of use of the various pesticide types in Ontario (Figures 2-8).

The efforts of several members of the Plant Industry Branch and the Agricultural Representatives Branch, OMAF, in the data collection exercise are appreciated.

The Agricultural Statistics Division of Statistics Canada, Ottawa, chose the sample for the field crop segment of the survey, provided the necessary mailing labels, and produced a host of tabulations and frequency distributions required for the analysis of the field crop survey.

Last, but not least, much credit goes to those Ontario farmers who responded to the pesticide survey.

INTRODUCTION

Organic pesticides have been used in Ontario since the end of the second World War. The concern expressed by many groups regarding the contamination of fish and wildlife resulted in the need to identify and quantify the pesticides used in the Great Lakes Watershed.

Canada and the United States signed the Great Lakes Water Quality Agreement in 1972. The International Joint Commission (IJC), acting for the two governments, oversees all activities in pursuance of this Agreement. As part of the Water Quality Agreement, the IJC established the Pollution from Land Use Activities Reference Group (PLUARG) to determine sources, quantify inputs, and assess the impact of inputs from a variety of land use activities on water quality. These activities include those involved with agriculture as well as forestry, city and urban areas, highways, and other industries. Documentation of the volume of each pesticide used in Ontario at both the county and watershed levels was essential to these studies.

The PLUARG group requested in 1972 that a survey of pesticide use be carried out every five years in the Province to identify and quantify the pesticides used in the Great Lakes Watershed. The data collected would be useful in estimating pesticide use in pursuance of the IJC Agreement; detecting trends in pesticide use by crop and by region in Ontario; and gauging the local and overall effectiveness of this Ministry's extension work in pest and weed control.

In 1973 and in 1978, surveys of agricultural pesticide use were carried out by the Ontario Ministry of Agriculture and Food (OMAF) in consultation with personnel from the Ontario Ministry of the Environment, Agriculture Canada, the University of Guelph, and the Canadian Agricultural Chemical Association. The technical aspects of these surveys were handled primarily by the Statistics Section of OMAF's Economics Branch. The results appeared in **Survey of Pesticide Use in Ontario, 1973** [5] and **1978** [6]. Those reports dealt with three aspects of pesticide use: field crops, fruit and vegetable crops, and roadside spraying.

The 1983 survey of pesticide use on field crops consisted of a questionnaire mailed to a sample of 10,000 farmers. The survey of pesticide use on fruits and vegetables was sent to 1,450 producers, while the roadside spraying data were collected by weed specialists of the Plant Industry Branch, OMAF. This report presents the findings of these studies.

SURVEY OF PESTICIDE USE ON FIELD CROPS

SAMPLE SELECTION AND MAILOUT

The Agriculture Statistics Division of Statistics Canada maintains, on an ongoing basis, a list of all agricultural holdings in Canada. This list, known as the Farm Register, contains all current census farms. The most recent Census of Agriculture, conducted on June 3, 1981, defined a census farm as an agricultural holding receiving $250 or more from the sale of agricultural products during the previous year.

After discussions with the Economics Branch, OMAF, the Agriculture Statistics Division agreed to generate the sample (names and addresses) required for the Pesticide Use Survey from the Farm Register subject to the following constraints:

1. A total sample size of 10,000 farms was to be selected for the study. This choice was consistent with the resources available and the sample size required to yield sufficient confidence in the results, assuming a 30 to 40 percent response rate.

2. The sample was to be drawn from a sub-population taken from the 1981 Census of Agriculture for Ontario [7]. This sub-population consisted of all census farms having a total of 7 hectares or more grown to winter wheat, oats, barley, mixed grain, corn, soybeans, dry field beans, or tobacco. (Confidentiality requirements dictated that Statistics Canada augment this sample with a small number of farms having a total of less than 7 hectares of the aforementioned crops.) There were about 48,000 farms in this target population.

3. The sample of 10,000 farms was to be chosen from the sub-population according to a county level stratification. Simple random sampling was to be carried out within each county.

The sample sizes allocated to each county were determined as a compromise between two main considerations:

1. The distribution of total pesticide use in the 1978 version of the survey; and

2. The distribution of the principal field crops in the Province.

The individual allocations for these two criteria differed only moderately from each other.

Subsequent to selecting the sample, the Agriculture Statistics Division generated a number of tabulations and frequency distributions for both the sub-population and the sample farms. Analysis of these data confirmed that the sample was sufficiently representative of the target population.

The selected farmers received Pesticide Use Record Forms in April of 1983. They were requested to complete these forms during the crop growing season by noting the dates of application, crops sprayed, chemical product applied, concentration used, area sprayed, and the total amount of product used. A summary questionnaire mailed to the same panel in September 1983 asked them to record the crop, chemical product used, concentration, area grown, area sprayed, and total quantity of product applied. This latter form was to be returned to the Economics Branch, while the producer was encouraged to keep the record sheet for his own files.

Of the 10,000 forms sent out, about 2,500 were returned. A systematic sample of the non-respondents was made by telephone to check for representativeness of the responding versus non-responding producers. The telephone follow-up resulted in the capture of a further 500 records bringing the grand total to 3,000.

EDITING

The questionnaires were edited to a standard of conformity that would allow the data to be analyzed. Each questionnaire was checked manually by personnel from the Provincial Pesticide Residue Testing Laboratory and by computer for internal consistency and completeness.

Care was taken to ensure that the ratio of product used to area sprayed was logical as an application rate. In cases where the amount of product used or the area treated were not filled in, it was often possible to impute the missing data by using recommended standard concentrations. Quantities of active ingredients for each chemical were calculated by multiplying total product used times the proportion of active ingredient contained in that product.

Occasionally, pesticides are applied as a combination of two or more chemicals. An example of this is the herbicide blazine, which is actually a combination of cyanazine and atrazine. Whenever such combinations were given as responses to the survey, the contribution of each component was estimated separately using standard mixing ratios. For purposes of this study, such estimates were added to the usage of the individual chemical. For example, the cyanazine component of blazine applications was credited to total cyanazine use. The atrazine component was treated in an analogous fashion while no separate estimate was made for blazine.

EXPANDING THE SAMPLE DATA

The main purpose of the survey was to calculate the use of pesticides in the major Ontario river basins that drain into the Great Lakes. The estimation technique consisted of expansion to: (1) the county level; and (2) the drainage basin level.

County Level

Each questionnaire contained a numerical geographic code. Using this unique identification number, the Agriculture Statistics Division of Statistics Canada was able to perform a computer match of those producers who completed the Pesticide Use Survey with their responses to the 1981 Census of Agriculture. Specifically, this meant that summary tables for each of the major field crops could be produced at the county level collectively for the 3,000 producers who responded to the Pesticide Use Survey.

The importance of this point is three-fold:

1. These tabulations provide a final check for representativeness of the responding portion of the sample.

2. Whereas farmers often listed only those crops which they had treated with pesticides, the 1981 census data covering all field crops were used to complete the pesticide questionnaire. Otherwise, estimates of pesticide use would have been inflated.

3. The expansion factor for each crop in each county is unique. It is calculated as the ratio of the total area of a particular crop in the county to the area of that crop reported in the questionnaires returned from that county. See Appendix I for a detailed example of this calculation.

In some counties, the estimated use of specific pesticides is zero when, in fact, it is likely that these chemicals had been applied. There are two main reasons for this result:

1. The use of such pesticides was not detected in the sample; or

2. The area grown to a particular field crop, while existent, was too small to be estimable in a county - hence, no expansion factor could be computed.

River Basin Level

Watersheds do not follow county boundaries. Some basins drain only part of one or two counties, while others may cover parts of five or six counties and drain one county completely.

The 1978 Survey of Pesticide Use listed and computed pesticide use for each of 16 different basins. To simplify the analysis and remove the necessity for small area estimates, the following changes in river basin delineation have taken place in this study (Figure 1):

1. The Ausable and Bayfield River basins have been combined with the Maitland River basin.

2. The Nottawasaga River basin has been combined with the Sauble, Big Head, and Beaver River basins and the Owen Sound lakefront.

3. The Kettle, Catfish and Big Otter Creek basins have been combined with the Big Creek and Lynne River basins and the Haldimand lakefront.

4. The Raisin, Baudet and Delisle River basins have been excluded from the tabulations.

Estimates have been made in this study for each of the resulting 12 groups of river basins. In addition, the "lakeside land" categories of Huron, St. Clair, Erie and Ontario have been maintained in order to account for land not considered to fall into a river basin, but still lying in close proximity to each of the lakes.

The drainage basin boundaries were originally outlined on township level maps. These were designed to conform as closely as possible with the river basins used in the 1978 study with the added constraint that townships would not be subdivided. (The 1978 survey differed in that proportions of each township located in each river basin had been derived and used in the estimation procedure.)

Since the numerical geographic code contained on each questionnaire indicated township as well as county location, it was a straightforward matter to assign respondents to the appropriate river basin. Then, depending upon crop and county, the expansion factors described previously could be applied to the pesticide use of each sample individual in a particular river basin. Summation through all such results gives rise to the estimated pesticide use for the drainage basin in question.

Mathematically, this gives the same results as summing the sample pesticide use by crop for each county contained (whole or in part) in the river basin and then applying the appropriate expansion factors.

SURVEY OF PESTICIDE USE ON FRUIT AND VEGETABLE CROPS

SAMPLE SELECTION AND MAILOUT

The responsibility for conducting the fruit and vegetable segment of the Pesticide Use Survey was assigned to the Plant Industry Branch, OMAF in cooperation with the Economics Branch.

A sample of 1,450 fruit and vegetable growers was selected using the 1981 Ontario Tree Fruit Census and Grape Census, as well as Plant Industry Branch grower listings.

Forms were mailed to producers in the spring. During the crop growing season, each grower was asked to record the dates of pesticide applications, crops sprayed, area sprayed, chemical product applied, concentration used, and total amount of product. In September 1983, another questionnaire was mailed to the same growers. They were requested to fill in these forms using the spray records collected during the summer and return them to the Ontario Ministry of Agriculture and Food field offices.

Of the 1,450 questionnaires sent out, about 400 forms were returned. An additional 160 forms were added from field crop survey records which had also included data on fruit and vegetable spraying. A sample of 50 non-respondents, contacted by telephone, indicated the same frequency of spray practices among respondents and non-respondents. Subsequent to the telephone follow-up, manual editing of forms, and removal of duplicates, about 560 records remained which were considered to be acceptable. The final 1983 sample had nearly twice as many respondents as the 1978 survey.

EDITING

All returned questionnaires were verified for general conformity to pesticide spraying practices as outlined in the Ontario Ministry of Agriculture and Food's 1983 Fruit [3] and Vegetable [4] Production Recommendations. Pesticide specialists in Vineland Station and Simcoe, employed by the Plant Industry Branch, scrutinized the questionnaires.

EXPANDING THE SAMPLE DATA

The first step was to estimate the total use of pesticide for the province by applying appropriate raising factors to the sample data. These raising factors were calculated as the ratios of the 1982 provincial area for each fruit and vegetable crop [2] to the corresponding area reported in the survey. The 1982 provincial areas were used because the 1983 data were not yet available. However, the areas of most fruit and vegetable crops were not expected to vary greatly between the two years.

Pesticide quantities used by county and by river basin were derived employing proportional area breakdowns following the estimation of the active ingredients of each specific pesticide by commodity at the provincial level. The area distributions of these crops were obtained from the 1981 Census of Agriculture in order that township data could be assigned to river basins.

For the estimation of pesticide use on fruit and vegetable crops, the technique outlined above is preferable to that used for field crops. The main reason is that low sample sizes for fruits and vegetables in some counties can produce distorted results for those counties. More reliable results are obtained by first estimating provincial pesticide use and then allocating to counties on the basis of area grown. The assumption here is that fruit and vegetable crops are sprayed using similar chemicals at the same concentration regardless of their location in the province.

As was the case with field crops, the sample occasionally had limitations in that certain pesticides or crops were not adequately represented and hence, pesticide use in such instances could not be estimated. For example, there were insufficient sample data to make separate estimates for cabbage, although it was possible to produce results for cole crops as a whole.

SURVEY OF PESTICIDE USE IN ROADSIDE SPRAYING

DATA COLLECTION

During the summer of 1983, a tally of herbicide use on county and municipal roadsides was compiled by personnel from the Plant Industry Branch, OMAF. Weed specialists contacted the authorities responsible for roadside spraying and collected data on herbicide applications.

The Guelph office of the Plant Industry Branch recorded the quantity and concentration of herbicides used on roadsides, examined the data for consistency, and tabulated the results at the county level.

ESTIMATION

No estimation was effected at the county level since all treatment data were available for each county reporting. However, it should be noted that spraying programs do not exist for some counties; in such cases, no attempt was made to produce estimates for roadside spraying.

River basin estimates were produced using proportional breakdowns of county data according to the total amount of land in the river basins as compared to the area in the county. For example, since about 60 percent of the total land in Lambton County lies in what has been defined as the Sydenham River basin, then 60 percent of the herbicides used in roadside spraying for Lambton County were credited to the Sydenham River basin. Contributions to this basin from other counties were treated in a similar fashion with the total estimate for the basin being obtained as the summation of all such parts. The main assumption in this technique is that roads are somewhat homogeneous within counties.

SUMMARY OF RESULTS

PRESENTATION

The results of the three separate surveys are presented numerically in Appendices II through XVIII, and visually in Figures 2 through 8. Specific pesticides have been listed by their common names in the tables to avoid bias towards trade names. Appendix XIX lists all the common names reported in the surveys along with their appropriate trade names.

Appendix II lists the area treated and total amount of active ingredient of each pesticide used for each field crop in the Province. Estimates of area treated were derived by dividing the total quantity of pesticides used by the corresponding rate of application as reported in the sample.

Appendix III shows the quantity of each type of pesticide used in Ontario on field crops aggregated at the county level. The groups of pesticides include triazine herbicides, phenoxy herbicides, other herbicides, insecticides, nematocides, and growth regulators. The area of improved land in each county, extracted from the 1981 Census of Agriculture, is also presented in the table. The area of improved land consists of crop land, improved pasture, summerfallow, other cultivated land lying idle, and area of barnyards, home gardens, farm lanes and roads.

The amounts of pesticides used on field crops in the various Ontario drainage basins are presented in Appendix IV. Total land area within each basin, regardless of its agricultural, urban, or other use, was estimated to enable comparisons of pesticide use relative to different basins. The drainage basins are grouped under the lakes into which they drain. The groupings called "Lakeside Land" include the numerous small creeks which flow into each lake as well as land lying in proximity to the lakes.

Data on the quantity of active ingredients of specific pesticides used in four commonly studied watersheds were tabulated (Appendix V) to give an indication of field crop spraying in the major basins. Estimates included were for the Thames, Grand, and Saugeen River basins and the Kettle to Haldimand grouping.

The quantities of pesticide active ingredients of each type of chemical applied to various fruit crops in Ontario during 1983 are shown in Appendix VI. Data on the treatment of other crops such as cantaloupes and blueberries were not sufficient to warrant publication. Nursery stock spraying is also excluded. The pesticides

which are used on fruit are further broken down in Appendix VIII which gives the specific pesticides used.

Appendices X and XI indicate the quantities of each type of pesticide used on fruit crops distributed according to county and river basin, respectively.

Tabulations of pesticide use on major vegetable crops, excluding greenhouse vegetables, are published in Appendix VII. Breakdowns for each specific pesticide, county level tabulations, and drainage basin estimates for vegetables are available in Appendices IX, X, and XII, respectively.

The quantity of herbicides used in the treatment of roadside weeds is tabulated by county in Appendix XIII. The chemicals used for this purpose are primarily phenoxy herbicides. Estimated use on roadsides, broken down by river basin, is presented in Appendix XIV.

Total pesticide use on field crops, fruits, vegetables, and roadsides is summarized in Appendix XV through XVIII. Appendix XV indicates the total area grown to major field crops, fruits and vegetables in addition to active ingredients of each type of pesticide applied. For field crops, estimates of total area sprayed, based upon sample proportions, are also presented.

A list of specific pesticides used on all items can be found in Appendix XVI. The county and regional breakdown of pesticide types appears in Appendix XVII while Appendix XVIII quantifies total agricultural pesticide use in the various drainage basins.

The data from the pesticide use surveys for field crops, fruits, vegetables, and roadsides were combined at the county level to estimate the approximate total amounts of each type of pesticide applied. The quantities of active ingredient used per total land area in each county were computed and are portrayed on seven maps (Figures 2 to 8). These maps show the amounts of triazine, phenoxy, and other herbicides as well as fungicides, insecticides, nematocides, and growth regulators in terms of application rates per hectare of total land area.

A map of Ontario showing the counties and districts appears in Figure 9.

HIGHLIGHTS

The highlights of the 1983 Survey of Pesticide Use can be summarized as follows:

Provincial Level

Pesticides used on field corn (3798 tonnes), tobacco (2259 tonnes), and soybeans (1282 tonnes) accounted for nearly 95 percent of total pesticide applications on field crops (Appendix XV).

By far the widest application of triazine herbicides is for the treatment of field corn while phenoxy herbicides are used primarily on cereal grains. Other types of herbicides are used most often on corn, soybeans, and vegetables (Appendix XV).

The herbicides used in largest quantities on field crops in the Province were atrazine (1720 tonnes), alachlor (1056 tonnes), metolachlor (826 tonnes), and cyanazine (430 tonnes). By way of comparison, the corresponding amounts estimated in the 1978 survey were 1411, 463, 50, and 505 tonnes, respectively. In 1983, these four chemicals comprised 75 percent of all herbicides (5411 tonnes) used on field crops; in 1978, they represented 60 percent of the 4075 tonnes of herbicides applied to field crops. Applications of butylate on field crops decreased from 734 tonnes five years ago to 291 tonnes in 1983 (Appendix II).

Total insecticide use on field crops was estimated to be 187 tonnes in 1983. Field corn, which accounted for nearly 80 percent of this quantity, received some 72 tonnes of terbufos and 33 tonnes of fonofos. About 16 tonnes of acephate and 14 tonnes of chlorpyrifos were applied to tobacco (Appendix II).

Almost 1611 tonnes of nematocides, primarily mixtures of 1, 3 dichloropropene plus 1, 2 dichloropropane (DCP), methylisothiocyanate, and chloropicrin, were applied to tobacco. Close to 590 tonnes of the growth regulator, decyl alcohol, were also applied to tobacco (Appendix II).

Pesticides used on apples (275 tonnes), grapes (127 tonnes), and peaches (61 tonnes) represented over 80 percent of all pesticides used on fruit crops (Appendix VI).

Fungicides and insecticides were by far the most significant pesticides used on fruits. The major fungicides were metiram (120 tonnes), captan (104 tonnes), and mancozeb (81 tonnes). The most frequently used insecticides were phosmet (36 tonnes), azinphos-methyl (26 tonnes), and carbaryl (22 tonnes) (Appendix VIII).

Pesticides used on potatoes (100 tonnes), tomatoes (100 tonnes), and sweet corn (53 tonnes) accounted for 70 percent of pesticides used on vegetables (Appendix VII).

Fungicides and insecticides were the most significant pesticides used on vegetable crops. Largest amounts of fungicides used were captan (58 tonnes), mancozeb (30 tonnes), maneb (22 tonnes), metiram (19 tonnes), and captafol (17 tonnes). Carbofuran (36 tonnes) and carbaryl (14 tonnes) were the most commonly used insecticides. Approximately 100 tonnes of herbicides were also applied to vegetables (Appendix IX).

Although roadside spraying represented less than one percent of all pesticides used, these treatments accounted for nearly 12 percent of the total phenoxy herbicides applied in the province (Appendix XV).

About 27 percent (2365 tonnes) of all pesticides used in Ontario were triazine herbicides, and 31 percent (2720 tonnes) were herbicides other than the triazine or phenoxy types (Appendix XV).

According to the survey, there were eight specific chemicals with total use in excess of 200 tonnes. Although some of these can be or are used in combination with other treatments, the list includes atrazine, alachlor, metolachlor, cyanazine, butylate, metribuzin, DCP, and decyl alcohol. The use of 2,4-D was also significant (Appendix XVI).

County Level

All application rates in the following discussion refer to the amount of pesticide used per hectare of total land.

In all counties in the southern Ontario region, at least 0.2 kg/ha of triazine herbicide was applied. In western Ontario, Bruce, Huron, Perth, Waterloo, and Wellington counties reached this level of application. Other counties with greater than 0.2 kg/ha were Durham, Northumberland, Dundas, and Glengarry (Figure 2).

The heaviest use of phenoxy herbicides was in Haldimand-Norfolk, Oxford, Huron, Perth, and Russell counties, each of which had application rates in excess of 0.1 kg/ha (Figure 3).

Application rates for herbicides other than the triazine or phenoxy types were highest in southern Ontario. Each county in this region exceeded 0.25 kg/ha with Brant, Elgin, Essex, Kent, Lambton, Middlesex, and Oxford being higher than 0.7 kg/ha. In western Ontario, the use of these other herbicides was greater than 0.25 kg/ha in Huron, Peel, Perth, and Waterloo while in central Ontario, Prince Edward county had the highest rate of application (Figure 4).

Insecticide use per hectare was largest in Niagara at over 0.3 kg/ha. In Brant, Essex, Haldimand-Norfolk, Hamilton-Wentworth, Kent, Middlesex, Oxford, and Waterloo, rates for insecticide applications exceeded 0.1 kg/ha (Figure 5).

Fungicide use was also highest in Niagara at 0.9 kg/ha. Other counties having application rates for fungicides in excess of 0.1 kg/ha included Essex, Haldimand-Norfolk, Hamilton-Wentworth, Kent, and Prince Edward (Figure 6).

Reflecting the distribution of the area grown to tobacco, the most significant applications of nematocides (over 1.0 kg/ha) occurred in Brant, Elgin, and Haldimand-Norfolk. Rates in excess of 0.1 kg/ha were also applied in Middlesex, Oxford, and Northumberland (Figure 7).

Similarly, appreciable amounts of growth regulators were apparent in Brant, Elgin, Haldimand-Norfolk, and Oxford counties, each of which had rates higher than 0.2 kg/ha while Middlesex county averaged 0.1 kg/ha (Figure 8).

River Basin Level

During 1983, the following amounts of pesticide active ingredient were used in the four major groups of river basins that drain into the Great Lakes system: Lake Huron - 1527 tonnes; Lake St. Clair - 2093 tonnes; Lake Erie - 3632 tonnes; and Lake Ontario - 1154 tonnes (Appendix XVIII).

By way of comparison, these estimates are each significantly higher than the 1978 survey figures of 1200, 1571, 2534, and 1045 tonnes, respectively.

APPENDICES

APPENDIX I

EXAMPLES OF METHODOLOGY USED IN THE ESTIMATION OF PESTICIDE USE AT THE COUNTY AND RIVER BASIN LEVELS - FIELD CROPS

COUNTY LEVEL

The expansion factor for each crop in each county depends upon the total area of each crop in the county [1] and the area of that crop reported in the returned questionnaires.

Example:

Elgin County:

Total area of corn in 1983 ..... 54 600 ha
Total area of corn reported in sample ..... 10 380 ha
Therefore, expansion factor for corn in Elgin is: $\frac{54\ 600}{10\ 380} = 5.26$

The total quantity of active ingredient of a particular pesticide was calculated by multiplying the expansion factor for the crop treated in a county by the amount of active ingredient reported for that county in the sample.

Example:

Elgin County:

Total quantity of active ingredient of atrazine used on corn in the sample ..... 12 700 kg
Therefore, total quantity of active ingredient of atrazine used on corn in Elgin would be: 12 700 x 5.26 = 66 800 kg

RIVER BASIN LEVEL

Pesticide use at the drainage basin level was estimated by summing the contributions made by each county or portion of a county contained in the basin.

If a county was wholly contained within a river basin, then its contribution towards the use of a particular pesticide on a crop grown in that basin was simply the estimated quantity of active ingredient as illustrated in the previous example.

However, if a county was only partially contained within a river basin, its contribution was calculated as the estimated quantity of active ingredient based only upon respondents who are located in those townships assigned to the drainage basin.

Example: (fabricated)

Suppose that a river basin is comprised of county X in its entirety, but only part of county Y. In estimating the quantity of active ingredient of atrazine applied

to corn in this basin, the first step is to visually judge as best as possible those whole townships in county Y which should be assigned to the drainage basin in question. Denote these townships collectively as "region Z".

Further, suppose that:

Sample total of active ingredient of atrazine used on corn in county X is	10 000 kg
Sample total of active ingredient of atrazine used on corn in region Z (contained within county Y) is	5 000 kg
Expansion factor for corn in county X is	6.80
Expansion factor for corn in county Y is	8.30

Then the total quantity of active ingredient of atrazine on corn in the river basin would be estimated as:

(10 000 x 6.80) + (5 000 x 8.30) = 109 500 kg

Note that while this estimate does not depend on the sample total of active ingredient of atrazine used on corn in county Y, the expansion factor for corn in county Y is required.

This method of estimation differs from that used in the 1978 study. At that time, pesticide use at the drainage basin level was estimated by using the ratio of a particular crop's area in a county that falls within the drainage basin to the total area of that crop in the entire county. See [6] for further details.

APPENDIX II - Area Treated and Total Quantities of Pesticide Active Ingredients used on Field Crops in Ontario, 1983

Pesticide Used by Crop	Area Treated	Amount Used
	ha	kg
HERBICIDES		
Field Corn		
2,4-D (p)	68 700	35 760
2,4-DB (p)	220	60
EPTC (o)	1 080	6 640
MCPA (p)	2 790	1 500
MCPB (p)	310	280
alachlor (o)	233 000	614 680
atrazine (t)	777 000	1 719 840
bentazon (o)	7 280	6 730
bromoxynil (o)	13 700	5 280
butylate (o)	72 300	288 020
cyanazine (t)	198 000	430 050
dicamba (p)	106 000	41 050
glyphosate (o)	2 260	4 140
linuron (o)	4 410	4 680
mecoprop (p)	26 300	2 850
metolachlor (o)	211 000	491 020
simazine (t)	570	730
Total		3 653 310
Soybeans		
2,4-D (p)	180	100
acifluorfen (o)	4 470	2 400
alachlor (o)	181 000	436 800
bentazon (o)	20 900	21 820
butylate (o)	7 660	2 690
chloramben (o)	32 800	44 620
dicamba (p)	150	30
diclofop-methyl (o)	1 410	660
fluazifop-butyl (o)	370	610
glyphosate (o)	19 600	28 450
linuron (o)	128 000	144 990
mecoprop (p)	140	20
metobromuron (o)	7 450	10 110
metolachlor (o)	147 000	325 450
metribuzin (t)	274 000	192 100
monolinuron (o)	2 870	2 680
sethoxydim (o)	11 100	4 150
trifluralin (o)	52 600	64 200
Total		1 281 880
Field Beans		
EPTC (o)	4 130	15 010
alachlor (o)	2 130	4 710
bentazon (o)	230	260
chloramben (o)	680	790
diquat (o)	2 150	1 090
glyphosate (o)	1 110	1 380
linuron (o)	150	90
metobromuron (o)	14 400	16 970
metolachlor (o)	3 940	9 930
metribuzin (t)	1 100	630
monolinuron (o)	1 330	1 400
sethoxydim (o)	30	40
trifluralin (o)	4 600	5 090
Total		57 390
HERBICIDES (cont'd)		
Tobacco		
diphenamid (o)	6 450	13 620
glyphosate (o)	620	1 000
napropamide (o)	230	70
pebulate (o)	710	3 040
trifluralin (o)	110	120
Total		17 850
Grain		
2,4-D (p)	148 000	114 150
2,4-DB (p)	49 000	45 100
MCPA (p)	120 000	154 250
MCPB (p)	15 100	15 640
amino triazole + ammonium thiocyanate (o)	270	490
bromoxynil (o)	4 020	1 410
cyanazine (t)	690	300
dicamba (p)	17 700	3 080
difenzoquat (o)	1 480	2 910
glyphosate (o)	19 900	37 550
mecoprop (p)	13 000	1 160
propanil (o)	110	100
Total		376 140
Hay and Pasture		
2,4-D (p)	3 200	2 870
2,4-DB (p)	9 300	10 220
EPTC (o)	1 810	4 560
MCPA (p)	1 570	1 450
MCPB (p)	400	560
dalapon (o)	190	400
dicamba (p)	30	30
glyphosate (o)	1 610	2 470
propyzamide (o)	20	70
trifluralin (o)	760	2 060
Total		24 690
INSECTICIDES		
Field Corn		
carbaryl	70	120
carbofuran	9 490	7 770
chlordane	400	1 040
chlorfenvinphos	90	80
chlorpyrifos	7 700	7 790
diazinon	1 440	5 200
disulfoton	8 020	10 170
fonofos	27 400	32 970
isofenphos	3 660	2 710
permethrin	400	80
phorate	4 370	4 880
terbufos	66 000	72 340
Total		145 150
INSECTICIDES (cont'd)		
Field Beans		
carbaryl	140	170
demeton	1 760	1 120
Total		1 290
Tobacco		
Bacillus thuringiensis	3 440	2 690
acephate	19 500	15 780
chlorpyrifos	9 580	13 990
cypermethrin	7 500	790
deltamethrin	3 870	70
diazinon	1 390	400
endosulfan	540	310
lindane	1 340	110
malathion	390	120
oxydemeton-methyl	6 170	2 500
permethrin	7 480	730
perimicarb	130	40
trichlorfon	1 710	2 360
Total		39 890
Grain		
carbaryl	50	40
Hay and Pasture		
dimethoate	870	240
FUNGICIDES[a]		
Tobacco		
benomyl	230	140
metalaxyl	1 990	930
Total		1 070
Grain		
chlorothalonil	130	110
NEMATOCIDES		
Tobacco		
chloropicrin	7 303	73 970
dazomet	3	200
dichloropropenes + dichloropropanes	32 600	1 350 380
metam-sodium	10	260
methylisothiocyanate	22 800	185 800
Total		1 610 610
GROWTH REGULATORS		
Tobacco		
decyl alcohol	20 500	590 270
ethephon	830	550
Total		590 820

[a] Fungicides used for greenhouse and seed treatments are excluded.
(t) triazine herbicide
(p) phenoxy herbicide
(o) other herbicide

APPENDIX III - Quantities of Active Ingredients of Each Type of Pesticide Used on Field Crops in 1983, by County and District, Ontario

Counties and Districts	Improved Area	Herbicides			Insecticides	Nematocides	Growth Regulators
		Triazine	Phenoxy	Other			
	hectares			- kilograms -			
Brant	64 985	49 730	5 670	91 980	8 720	406 310	24 410
Elgin	134 097	83 650	11 570	194 530	7 830	179 470	52 700
Essex	133 476	55 790	4 560	190 550	700	5 180	920
Haldimand-Norfolk	189 354	83 050	31 860	131 690	22 040	736 030	403 290
Hamilton-Wentworth	55 462	25 350	8 070	26 460	6 670	-	-
Kent	213 844	203 200	13 020	357 070	13 440	12 100	2 160
Lambton	208 071	192 980	22 990	262 840	6 100	-	-
Middlesex	228 556	241 210	19 890	252 070	27 930	93 810	46 620
Niagara	89 010	59 160	1 740	45 290	770	-	-
Oxford	156 116	130 110	31 160	142 120	36 330	140 480	51 620
Southern Ontario	1 476 971	1 124 230	150 530	1 694 600	130 530	1 573 380	581 720
Bruce	208 083	131 580	29 890	29 940	3 170	-	-
Dufferin	72 130	8 460	6 190	750	-	-	-
Grey	196 089	21 630	16 770	7 440	10	-	-
Halton	41 577	7 370	2 350	-	-	-	-
Huron	255 771	230 620	32 910	276 300	15 150	-	-
Peel	47 501	21 500	2 830	34 540	-	-	-
Perth	182 812	200 590	26 510	79 070	18 930	-	-
Simcoe	190 450	55 910	13 400	98 210	80	-	-
Waterloo	86 184	61 910	10 900	57 340	13 450	-	-
Wellington	172 827	61 550	22 730	24 120	3 200	-	-
Western Ontario	1 453 424	801 120	164 480	607 710	53 990	-	-
Durham	117 990	78 100	10 560	40 850	190	14 890	3 640
Haliburton	2 434	-	-	-	-	-	-
Hastings	81 038	18 000	6 080	20 190	-	-	-
Muskoka	6 075	-	50	-	-	-	-
Northumberland	91 771	45 480	8 120	24 620	-	22 340	5 460
Parry Sound	19 276	-	170	-	-	-	-
Peterborough	75 600	17 800	5 200	11 000	1 540	-	-
Prince Edward	51 517	18 540	910	36 080	-	-	-
Victoria	91 703	22 920	4 340	32 400	-	-	-
York	83 733	41 010	11 840	29 890	360	-	-
Central Ontario	621 137	241 850	47 270	195 030	2 090	37 230	9 100
Dundas	60 311	20 120	3 900	15 570	-	-	-
Frontenac	50 295	3 470	7 060	4 920	-	-	-
Glengarry	58 790	25 920	5 140	18 930	-	-	-
Grenville	32 100	7 580	2 190	2 650	-	-	-
Lanark	59 778	16 490	3 130	13 100	-	-	-
Leeds	57 893	8 760	1 350	6 050	-	-	-
Lennox & Addington	51 162	11 580	2 320	24 290	-	-	-
Ottawa-Carleton	108 338	35 770	5 090	16 830	-	-	-
Prescott	70 473	9 000	5 270	7 010	-	-	-
Renfrew	95 435	8 980	3 490	1 680	-	-	-
Russell	37 880	12 180	14 520	5 880	-	-	-
Stormont	43 798	16 600	3 790	18 940	-	-	-
Eastern Ontario	726 253	176 450	57 250	135 850	-	-	-
Algoma	23 564	-	790	1 410	-	-	-
Cochrane	22 678	-	-	-	-	-	-
Kenora	8 222	-	-	-	-	-	-
Manitoulin	25 166	-	-	-	-	-	-
Nipissing	24 337	-	590	-	-	-	-
Rainy River	37 378	-	1 520	-	-	-	-
Sudbury	18 950	-	640	-	-	-	-
Thunder Bay	18 877	-	-	-	-	-	-
Timiskaming	61 594	-	7 090	2 850	-	-	-
Northern Ontario	240 766	-	10 630	4 260	-	-	-
Province	4 518 551	2 343 650	430 160	2 637 450	186 610	1 610 610	590 820

Note: Improved land area consists of cropland, improved pasture, summerfallow, other cultivated land lying idle, and area of barnyards, home gardens, farm lanes and roads (1981 Census of Agriculture).

APPENDIX IV - Quantities of Active Ingredients of Each Type of Pesticide Used on Field Crops in the Various Ontario Drainage Basins of the Great Lakes, 1983

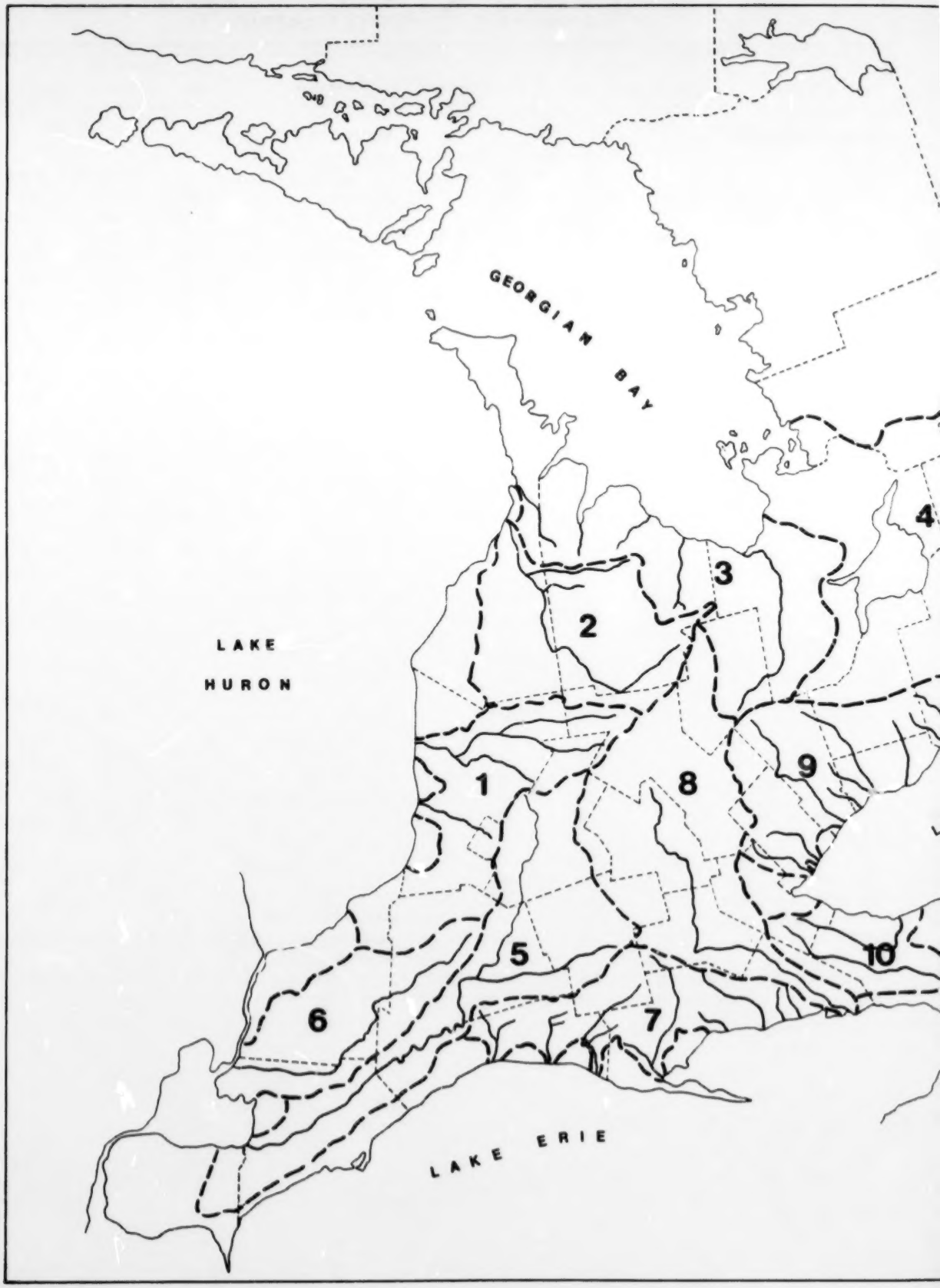
Drainage Basins	Total Area	Herbicides			Insecticides	Nematocides	Growth Regulators	Total
		Triazine	Phenoxy	Other				
	hectares				- kilograms -			
LAKE HURON & GEORGIAN BAY								
Ausable, Bayfield, Maitland.	443 470	308 980	47 620	281 820	15 900	-	-	654 320
Saugeen	391 140	129 580	32 580	28 750	1 940	-	-	192 850
Nottawasaga to Owen Sound ..	407 550	44 800	15 590	31 970	90	-	-	92 450
Holland, Severn	549 910	25 360	10 960	22 630	30	-	-	58 980
Lakeside Land	488 750	102 610	22 430	207 100	7 320	-	-	339 460
Total	2 280 820	611 330	129 180	572 270	25 280	-	-	1 338 060
LAKE ST. CLAIR								
Thames	594 340	563 170	63 980	624 260	72 020	127 250	58 990	1 509 670
Sydenham	315 150	176 430	18 660	206 630	5 950	-	-	407 670
Lakeside Land	92 770	19 840	900	49 320	-	-	-	70 060
Total	1 002 260	759 440	83 540	880 210	77 970	127 250	58 990	1 987 400
LAKE ERIE								
Kettle to Haldimand	301 180	125 930	44 870	276 440	38 000	994 600	491 340	1 971 180
Grand	656 810	199 360	43 860	212 790	32 500	448 580	31 390	968 480
Lakeside Land	311 200	161 900	8 210	287 120	3 450	2 950	-	463 630
Total	1 269 190	487 190	96 940	776 350	73 950	1 446 130	522 730	3 403 290
LAKE ONTARIO								
Oakville to Pickering	352 570	80 470	11 600	64 050	1 010	-	-	157 130
Welland, West Lincoln	178 730	20 920	2 260	21 690	-	-	-	44 870
Trent	1 050 840	128 150	18 970	89 660	1 540	-	-	238 320
Moira to Gananoque	676 910	18 460	10 120	42 590	-	-	-	71 170
Lakeside Land	865 640	76 290	17 380	79 740	6 860	37 230	9 100	226 600
Total	3 124 690	324 290	60 330	297 730	9 410	37 230	9 100	738 090
Total of Above	7 676 960	2 182 250	369 990	2 526 560	186 610	1 610 610	590 820	7 466 840
Remainder of Province	84 066 380	161 400	60 170	110 890	-	-	-	332 460
Total Province	91 743 340	2 343 650	430 160	2 637 450	186 610	1 610 610	590 820	7 799 300

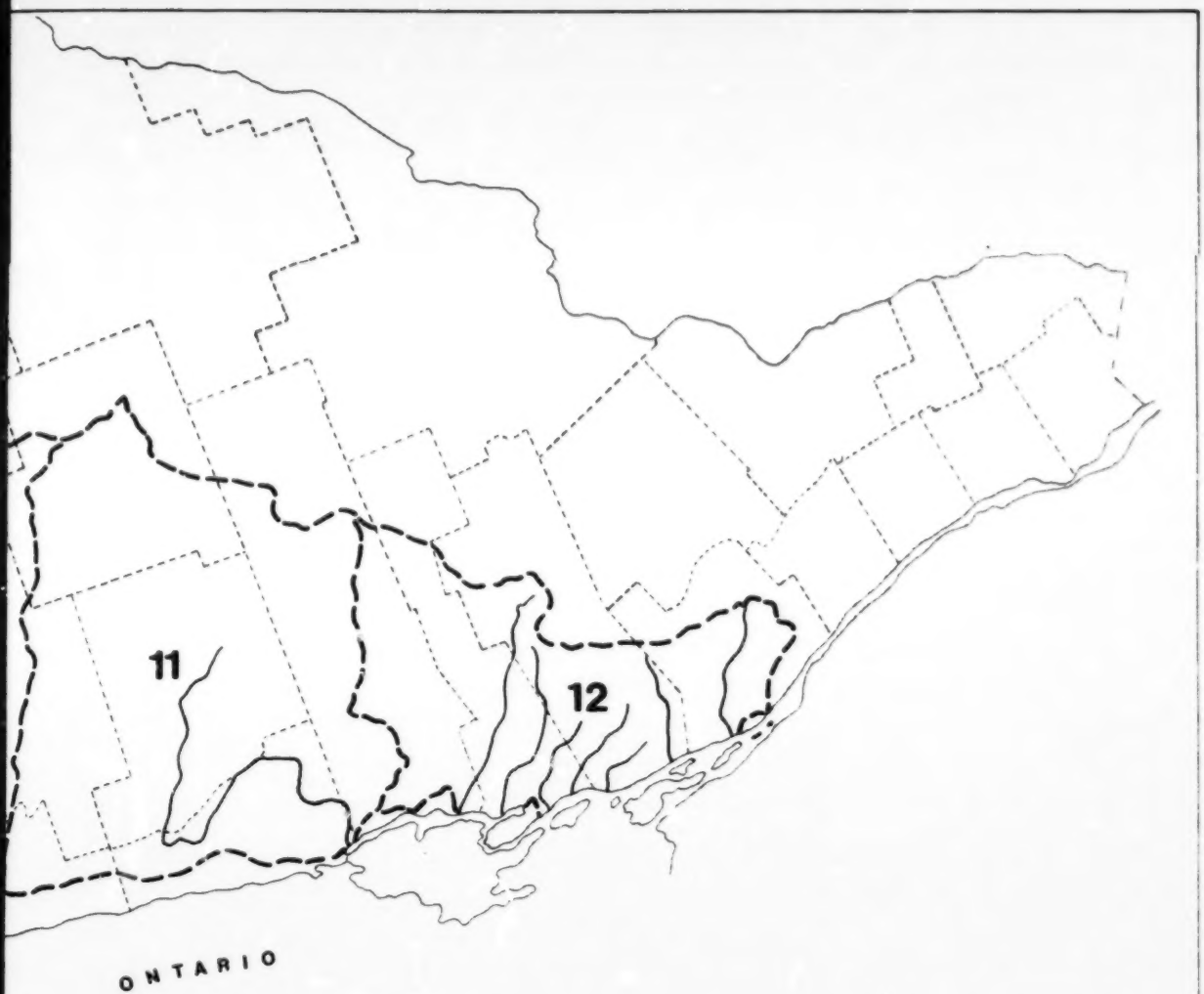
APPENDIX V - Quantities of Specific Pesticide Active Ingredients Used on Field Crops in Four Major Ontario Drainage Basins, 1983

Pesticide Used	Thames	Kettle to Haldimand	Grand	Saugeen
		- kilograms -		
TRIAZINE HERBICIDES				
atrazine	421 190	94 220	154 720	96 460
cyanazine	108 350	17 420	33 150	33 120
metribuzin	33 190	14 230	11 260	-
simazine	440	60	230	-
Total	**563 170**	**125 930**	**199 360**	**129 580**
PHENOXY HERBICIDES				
2,4-D	24 770	22 070	16 670	11 490
2,4-DB	7 900	1 290	5 230	3 360
MCPA	13 930	16 560	15 260	13 770
MCPB	1 600	40	870	10
dicamba	15 040	4 480	5 700	3 190
mecoprop	740	430	130	760
Total	**63 980**	**44 870**	**43 860**	**32 580**
OTHER HERBICIDES				
EPTC	7 640	2 110	880	-
aciflucrfen	1 570	260	170	-
alachlor	224 540	97 990	81 500	20 150
amino triazole + ammonium thiocyanate	-	80	400	-
bentazon	11 350	1 820	590	-
bromoxynil	1 630	1 730	660	-
butylate	61 200	43 190	12 750	6 240
chloramben	5 750	5 020	-	-
dalapon	30	-	-	-
diclofop-methyl	30	-	50	-
difenzoquat	160	-	-	-
diphenamid	600	10 520	2 500	-
diquat	160	-	-	-
fluazifop-butyl	480	130	-	-
glyphosate	7 110	4 230	7 790	2 040
linuron	32 580	17 230	10 160	-
metobromuron	6 950	360	110	-
metolachlor	246 310	83 820	88 540	320
monolinuron	360	980	-	-
napropamide	-	60	10	-
pebulate	1 020	1 800	-	-
propyzamide	-	-	70	-
sethoxydim	120	20	400	-
trifluralin	14 670	5 090	6 210	-
Total	**624 260**	**276 440**	**212 790**	**28 750**

Pesticide Used	Thames	Kettle to Haldimand	Grand	Saugeen
		- kilograms -		
INSECTICIDES				
Bacillus thuringiensis	-	2 070	620	-
acephate	1 600	10 390	3 690	-
carbaryl	80	40	-	-
carbofuran	6 210	630	-	-
chlordane	1 040	-	-	-
chlorpyrifos	7 070	10 230	1 790	-
cypermethrin	20	680	80	-
deltamethrin	10	50	-	-
diazinon	830	330	10	-
disulfoton	580	-	1 920	-
endosulfan	100	-	210	-
fonofos	19 200	1 320	3 660	1 940
isofenphos	670	200	-	-
lindane	30	30	50	-
malathion	-	60	60	-
oxydemeton-methyl	150	1 850	410	-
permethrin	120	550	130	-
phorate	1 160	1 940	410	-
pirimicarb	10	-	-	-
terbufos	32 960	5 540	19 370	-
trichlorfon	180	2 090	90	-
Total	**72 020**	**38 000**	**32 500**	**1 940**
NEMATOCIDES				
chloropicrin	4 960	34 300	31 290	-
dazomet	-	200	-	-
dichloropropenes + dichloropropanes	105 590	840 700	371 520	-
metam-sodium	-	260	-	-
methylisothiocyanate	16 700	118 940	45 770	-
Total	**127 250**	**994 600**	**448 580**	**-**
GROWTH REGULATORS				
decyl alcohol	58 880	490 900	31 390	-
ethephon	110	440	-	-
Total	**58 990**	**491 340**	**31 390**	**-**

FIGURE 1: River Basins Draining into the Great Lakes, 1983





LIST OF RIVER BASINS DRAINING INTO THE GREAT LAKES

LAKE HURON AND GEORGIAN BAY

1. AUSABLE RIVER, BAYFIELD RIVER AND MAITLAND RIVER
2. SAUGEEN RIVER
3. NOTTAWASAGA RIVER, SAUBLE RIVER, BIG HEAD RIVER, BEAVER RIVER AND OWEN SOUND LAKEFRONT
4. HOLLAND RIVER AND SEVERN RIVER

LAKE ST. CLAIR

5. THAMES RIVER
6. SYDENHAM RIVER

LAKE ERIE

7. KETTLE CREEK, CATFISH CREEK, BIG OTTER CREEK, BIG CREEK, LYNNE RIVER AND HALDIMAND LAKEFRONT
8. GRAND RIVER

LAKE ONTARIO

9. OAKVILLE CREEK, BRONTE CREEK, CREDIT RIVER, ETOBICOKE CREEK, MIMICO CREEK, HUMBER RIVER, TORONTO EAST LAKEFRONT, PICKERING LAKEFRONT
10. WELLAND RIVER AND WEST LINCOLN LAKEFRONT
11. TRENT RIVER
12. MOIRA RIVER, SALMON RIVER, NAPANEE RIVER, WILTON CREEK, MILLHAVEN CREEK, COLLINS CREEK, CATARAQUI RIVER AND GANANOQUE RIVER

APPENDIX VI - Quantities of Pesticide Active Ingredients of Each Type of Pesticide Used on Fruit Varieties in Ontario, 1983

Crop	Area Grown[a]	Herbicides			Fungicides	Insecticides	Total
		Triazine	Phenoxy	Other			
	hectares	- kilograms -					
Apples	10 856	380	-	240	204 230	70 060	274 910
Cherries	1 319	100	-	60	33 590	5 810	39 560
Grapes	9 470	1 410	-	1 680	94 050	29 890	127 030
Peaches	3 216	-	-	1 480	39 120	20 000	60 600
Pears	1 409	60	-	180	18 430	8 610	27 280
Plums and Prunes.	584	20	-	300	15 300	3 600	19 220
Raspberries	261	-	10	480	1 090	560	2 140
Strawberries	1 329	-	130	1 360	5 180	5 230	11 900
Total	28 444	1 970	140	5 780	410 990	143 760	562 640

[a] Area grown in 1982.

APPENDIX VII - Quantities of Pesticide Active Ingredients of Each Type of Pesticide Used on Vegetable Varieties in Ontario, 1983

Crop	Area Grown[a]	Herbicides			Fungicides	Insecticides	Total
		Triazine	Phenoxy	Other			
	hectares	- kilograms -					
Asparagus	884	730	-	690	-	1 370	2 790
Beans	2 812	-	230	940	10	20	1 200
Beets	262	-	1 240	-	-	-	1 240
Carrots	2 032	60	-	2 030	9 350	5 370	16 810
Celery	237	-	-	-	-	800	800
Cole Crops	3 255	-	-	860	3 790	4 870	9 520
Cucumbers	2 053	-	-	4 400	4 450	3 310	12 160
Onions	2 409	-	-	20 520	13 290	5 970	39 780
Parsnips	172	-	-	80	-	80	160
Peas	9 065	60	5 050	1 010	-	3 940	10 060
Peppers	886	40	-	1 280	1 200	2 800	5 320
Potatoes	15 499	2 180	-	17 360	46 870	33 520	99 930
Pumpkin and Squash	445	-	-	610	260	340	1 210
Rutabagas	1 445	-	-	1 360	-	1 200	2 560
Sweet Corn	19 070	11 320	-	16 250	-	25 190	52 760
Tomatoes	12 384	4 730	20	7 850	75 500	11 720	99 820
Total	72 910	19 120	6 540	75 240	154 720	100 500	356 120

[a] Area grown in 1982.

APPENDIX VIII - Quantities of Specific Pesticide Active Ingredients Used on All Fruit in Ontario, 1983

Pesticide Used	Quantity	Pesticide Used	Quantity
HERBICIDES	kilograms	**INSECTICIDES**	kilograms
2,4-D (p)	140	azinphos-methyl	25 670
amino triazole + ammonium thiocyanate (o)	60	carbaryl	22 410
chloroxuron (o)	120	carbofuran	310
dalapon (o)	40	chinomethionat	1 070
dichlobenil (o)	340	cyhexatin	7 810
diuron (o)	1 140	deltamethrin	10
glyphosate (o)	590	demeton	170
linuron (o)	560	diazinon	3 950
paraquat (o)	1 770	dicofol	6 320
sethoxydim (o)	70	dimethoate	1 280
simazine (t)	1 970	dinocap	7 160
terbacil (o)	1 090	endosulfan	5 270
Total	7 890	fenbutatin oxide	150
		fenvalerate	1 230
FUNGICIDES		formetanate hydrochloride	1 010
benomyl	4 210	malathion	350
captafol	1 400	methidathion	220
captan	104 240	methomyl	2 120
chlorothalonil	280	methoxychlor	50
dichlone	1 590	mevinphos	80
dichloran	750	oxydemeton-methyl	10
dodine	6 440	parathion	2 790
ferbam	6 370	permethrin	320
fixed copper	20	phosalone	16 430
folpet	4 140	phosmet	35 720
iprodione	890	pirimicarb	100
mancozeb	81 180	propargite	1 750
metiram	119 610	Total	143 760
streptomycin sulfate	70		
sulphur	79 340		
thiophanate-methyl	20		
zineb	440		
Total	410 990		

Note: (t) triazine herbicide, (p) phenoxy herbicide, (o) other herbicide

APPENDIX IX - Quantities of Specific Pesticide Active Ingredients Used on All Vegetables in Ontario, 1983

Pesticide Used	Quantity
HERBICIDES	kilograms
2,4-D (p)	20
EBPC (o)	4 120
MCPA (p)	10
MCPB (p)	5 060
alachlor (o)	4 450
allidochlor (o)	19 160
atrazine (t)	9 840
bensulide (o)	1 360
bentazon (o)	940
bromoxynil (o)	390
butylate (o)	7 740
chloramben (o)	1 690
chlorbromuron (o)	510
chlorothal-methyl (o)	420
chlorpropham (o)	130
cyanazine (t)	1 470
dalapon (o)	750
dicamba (p)	130
diclofop-methyl (o)	720
dinoseb (o)	790
diphenamid (o)	850
diquat (o)	430
diuron (o)	480
glyphosate (o)	570
loxynil (o)	460
linuron (o)	1 770
mecoprop (p)	80
metobromuron (o)	850
metolachlor (o)	16 240
metribuzin (t)	7 390
monolinuron (o)	260
napropamide (o)	180
naptalam (o)	1 780
paraquat (o)	160
prometryne (t)	120
pyrazon (p)	1 240
sethoxydim (o)	170
simazine (t)	300
trifluralin (o)	7 870
Total	100 900

Pesticide Used	Quantity
FUNGICIDES	kilograms
anilazine	120
benomyl	10
captafol	17 030
captan	20
chlorothalonil	57 700
fixed copper	7 230
mancozeb	30 230
maneb	22 070
metalaxyl	150
metiram	19 470
thiram	540
zineb	150
Total	154 720
INSECTICIDES	
Bacillus thuringiensis	1 240
acephate	340
aldicarb	5 230
azinphos-methyl	4 810
carbaryl	13 740
carbofuran	35 810
chlorpyrifos	7 470
cypermethrin	30
deltamethrin	10
diazinon	4 440
dimethoate	90
disulfoton	470
endosulfan	3 580
fensulfothion	500
fenvalerate	480
fonofos	7 160
malathion	5 720
methamidophos	2 410
methidathion	210
methomyl	520
methoxychlor	2 520
mevinphos	200
naled	380
oxydemeton-methyl	40
parathion	800
permethrin	590
phorate	470
phosmet	1 200
pirimicarb	40
Total	100 500

NOTE: (t) triazine herbicide, (p) phenoxy herbicide, (o) other herbicide

APPENDIX X - Quantities of Active Ingredients of Each Type of Pesticide Used on Fruit and Vegetables in 1983, by County and District, Ontario

Counties and Districts	Fruit						Vegetables					
	Herbicides						Herbicides					
	Tria-zine	Phen-oxy	Other	Fungi-cides	Insec-ticides	Total	Tria-zine	Phen-oxy	Other	Fungi-cides	Insec-ticides	Total
	- kilograms -											
Brant	10	-	50	5 530	1 960	7 550	350	160	1 480	3 740	2 470	8 200
Elgin	20	10	70	7 450	2 650	10 200	570	100	1 870	3 280	2 880	8 700
Essex	50	10	300	22 320	8 460	31 140	3 030	760	9 940	36 260	11 350	61 340
Haldimand-Norfolk	50	20	240	25 260	8 760	34 330	1 180	100	3 970	11 010	5 760	22 020
Hamilton-Wentworth	130	10	270	23 520	7 930	31 860	730	310	2 420	4 980	4 850	13 290
Kent	20	-	110	7 190	2 390	9 710	2 560	1 360	7 460	27 830	9 350	48 560
Lambton	10	-	70	5 430	1 880	7 390	230	40	4 660	6 120	3 550	14 600
Middlesex	20	-	70	9 140	3 220	12 450	2 420	380	4 470	2 360	7 190	16 820
Niagara	1 420	20	3 260	171 800	59 080	235 580	210	120	970	2 240	1 300	4 840
Oxford	10	-	60	7 410	2 630	10 110	900	710	1 860	610	2 920	7 000
Southern Ontario	1 740	70	4 500	285 050	98 960	390 320	12 180	4 040	39 100	98 430	51 620	205 370
Bruce	-	-	20	450	190	660	50	10	190	130	240	620
Dufferin	-	-	-	130	50	180	270	10	2 080	5 590	4 020	11 970
Grey	70	-	80	36 430	12 530	49 110	60	-	190	330	330	910
Halton	10	-	70	6 420	2 240	8 740	100	10	280	760	600	1 750
Huron	10	-	50	2 840	1 090	3 990	340	330	1 350	650	1 830	4 500
Peel	20	10	90	8 680	3 160	11 960	100	10	280	600	500	1 490
Perth	-	-	10	580	200	790	490	260	980	210	1 560	3 500
Simcoe	10	10	120	6 540	2 430	9 110	1 130	150	12 580	24 450	17 290	55 600
Waterloo	-	-	40	2 760	960	3 760	90	20	480	1 030	880	2 500
Wellington	-	10	80	2 270	900	3 260	70	10	310	430	500	1 320
Western Ontario	120	30	560	67 100	23 750	91 560	2 700	810	18 720	34 180	27 750	84 160
Durham	30	10	110	15 580	5 470	21 200	910	250	1 920	1 340	3 060	7 480
Haliburton	-	-	-	-	-	-	-	-	-	-	-	-
Hastings	-	-	20	1 690	610	2 320	260	10	430	170	670	1 540
Muskoka	-	-	10	20	10	40	10	-	40	70	60	180
Northumberland	40	10	90	19 470	6 810	26 420	960	190	1 730	920	2 720	6 520
Parry Sound	-	-	-	30	20	50	10	-	40	90	70	210
Peterborough	-	-	50	610	310	970	100	10	360	680	640	1 790
Prince Edward	20	10	80	8 620	2 900	11 630	990	940	2 060	3 440	3 340	10 770
Victoria	-	-	30	260	150	440	70	-	230	440	400	1 140
York	10	-	70	3 120	1 160	4 360	300	160	8 300	10 770	6 360	25 890
Central Ontario	100	30	460	49 400	17 440	67 430	3 610	1 560	15 110	17 920	17 320	55 520
Dundas	-	-	10	1 590	570	2 170	10	-	20	30	40	100
Frontenac	-	-	10	380	140	530	10	10	70	100	80	270
Glengarry	-	-	20	460	190	670	30	-	60	70	80	240
Grenville	-	-	10	1 090	400	1 500	20	10	60	90	90	270
Lanark	-	-	10	140	60	210	20	10	70	70	100	270
Leeds	-	-	20	890	340	1 250	50	-	90	60	130	330
Lennox & Addington	-	-	10	210	100	320	70	20	170	290	260	810
Ottawa-Carleton	10	10	80	2 550	980	3 630	130	30	310	370	480	1 320
Prescott	-	-	10	160	80	250	60	10	400	1 040	760	2 270
Renfrew	-	-	20	920	320	1 260	30	-	100	160	150	440
Russell	-	-	20	260	130	410	40	-	80	40	110	270
Stormont	-	-	-	60	20	80	10	-	20	10	20	60
Eastern Ontario	10	10	220	8 710	3 330	12 280	480	90	1 450	2 330	2 300	6 650
Algoma	-	-	-	120	50	170	30	10	90	90	120	340
Cochrane	-	-	-	10	10	20	20	-	120	320	240	700
Kenora	-	-	-	-	-	-	-	-	10	10	10	30
Manitoulin	-	-	10	170	60	240	10	-	40	50	60	160
Nipissing	-	-	-	10	-	10	10	10	50	90	90	250
Rainy River	-	-	-	80	20	100	-	-	20	50	40	110
Sudbury	-	-	10	110	40	160	40	10	270	620	480	1 420
Thunder Bay	-	-	10	100	50	160	30	10	230	570	420	1 260
Timiskaming	-	-	10	130	50	190	10	-	30	60	50	150
Northern Ontario	-	-	40	730	280	1 050	150	40	860	1 860	1 510	4 420
Province	1 970	140	5 780	410 990	143 760	562 640	19 120	6 540	75 240	154 720	100 500	356 120

APPENDIX XI - Quantities of Active Ingredients of Each Type of Pesticide Used on Fruit in the Various Ontario Drainage Basins of the Great Lakes, 1983

Drainage Basin	Herbicides			Fungicides	Insecticides	Total
	Triazine	Phenoxy	Other			
				- kilograms -		
LAKE HURON & GEORGIAN BAY						
Ausable, Bayfield, Maitland	10	-	60	4 330	1 610	6 010
Saugeen	-	-	20	780	320	1 120
Nottawasaga to Owen Sound	80	10	130	42 110	14 540	56 870
Holland, Severn	-	-	70	1 630	680	2 380
Lakeside Land	10	-	90	4 770	1 690	6 560
Total	100	10	370	53 620	18 840	72 940
LAKE ST. CLAIR						
Thames	30	10	160	13 170	4 680	18 050
Sydenham	-	-	20	1 320	490	1 830
Lakeside Land	-	-	10	600	230	840
Total	30	10	190	15 090	5 400	20 720
LAKE ERIE						
Kettle to Haldimand	70	20	310	34 350	11 990	46 740
Grand	20	10	140	10 470	3 720	14 360
Lakeside Land	60	-	350	26 160	9 680	36 250
Total	150	30	800	70 980	25 390	97 350
LAKE ONTARIO						
Oakville to Pickering	40	20	260	20 320	7 280	27 920
Welland, West Lincoln	940	10	1 880	110 920	36 780	150 530
Trent	40	10	220	21 000	7 600	28 870
Moira to Gananoque	-	-	20	630	250	900
Lakeside Land	640	20	1 800	106 320	37 810	146 590
Total	1 660	60	4 180	259 190	89 720	354 810
Total of Above	1 940	110	5 540	398 880	139 350	545 820
Remainder of Province	30	30	240	12 110	4 410	16 820
Total Province	1 970	140	5 780	410 990	143 760	562 640

APPENDIX XII - Quantities of Active Ingredients of each type of Pesticide used on Vegetables in the various Ontario Drainage Basins of the Great Lakes, 1983

Drainage Basin	Herbicides			Fungicides	Insecticides	Total
	Triazine	Phenoxy	Other			
				- kilograms -		
LAKE HURON & GEORGIAN BAY						
Ausable, Bayfield, Maitland	350	330	1 520	710	2 000	4 910
Saugeen	30	10	170	120	200	530
Nottawasaga to Owen Sound	1 030	60	7 730	18 740	13 800	41 360
Holland, Severn	220	160	12 460	14 840	8 780	36 460
Lakeside Land	330	70	5 730	7 600	5 240	18 970
Total	1 960	630	27 610	42 010	30 020	102 230
LAKE ST. CLAIR						
Thames	5 240	1 860	11 120	26 870	16 670	61 760
Sydenham	320	40	600	940	930	2 830
Lakeside Land	760	370	1 660	2 620	2 480	7 890
Total	6 320	2 270	13 380	30 430	20 080	72 480
LAKE ERIE						
Kettle to Haldimand	1 900	390	5 870	13 370	8 780	30 310
Grand	900	300	4 220	9 920	7 430	22 770
Lakeside Land	2 730	1 010	11 270	38 740	11 820	65 570
Total	5 530	1 700	21 360	62 030	28 030	118 650
LAKE ONTARIO						
Oakville to Pickering	460	120	1 340	3 250	2 630	7 800
Welland, West Lincoln	380	220	670	410	1 170	2 850
Trent	1 360	210	2 480	1 550	4 040	9 640
Moira to Gananoque	110	10	270	300	380	1 070
Lakeside Land	2 380	1 280	5 880	10 440	10 320	30 300
Total	4 690	1 840	10 640	15 950	18 540	51 660
Total of Above	18 500	6 440	72 990	150 420	96 670	345 020
Remainder of Province	620	100	2 250	4 300	3 830	11 100
Total Province	19 120	6 540	75 240	154 720	100 500	356 120

APPENDIX XIII - Quantities of Active Ingredients of Herbicides Used in Roadside Weed Control in 1983 by County and District, Ontario

Counties	Area of Roadside Treated	Amount of Herbicide Used
	ha	kg
Brant	900	1 390
Elgin	1 270	2 260
Essex	1 560	2 320
Haldimand-Norfolk	320	1 090
Hamilton-Wentworth	440	990
Kent	690	1 880
Lambton	1 820	2 720
Middlesex	2 360	4 220
Niagara	-	-
Oxford	1 580	3 540
Southern Ontario	10 940	20 410
Bruce	1 310	2 750
Dufferin	760	1 300
Grey	1 120	2 570
Halton	530	690
Huron	1 590	2 510
Peel	930	1 410
Perth	1 690	3 450
Simcoe	770	1 340
Waterloo	1 420	2 080
Wellington	1 250	2 170
Western Ontario	11 370	20 270
Durham	1 150	2 140
Haliburton	-	-
Hastings	-	-
Muskoka	-	-
Northumberland	300	600
Parry Sound	-	-
Peterborough	280	700
Prince Edward	700	1 120
Victoria	780	2 390
York	580	970
Central Ontario	3 790	7 920
Dundas, Stormont, Glengarry.	1 180	2 930
Frontenac	-	-
Grenville	-	-
Lanark	900	1 800
Leeds	-	-
Lennox & Addington	-	-
Ottawa-Carlton	-	-
Prescott	350	960
Renfrew	1 450	2 080
Russell	640	1 760
Eastern Ontario	4 520	9 530
Province	30 620	58 130

Note: Data not available for all counties. In some cases, no spraying program exists.

APPENDIX XIV - Quantities of Active Ingredients of Herbicides Used in Roadside Weed Control in the Various Ontario Drainage Basins of the Great Lakes, 1983

Drainage Basins	Amount of Herbicide Used
	kg
Lake Huron and Georgian Bay	
Ausable, Bayfield, Maitland	4 450
Saugeen	2 470
Nottawasaga to Owen Sound	3 920
Holland, Severn	2 170
Lakeside Land	1 240
Total	14 250
Lake St. Clair	
Thames	7 820
Sydenham	3 040
Lakeside Land	2 000
Total	12 860
Lake Erie	
Kettle to Haldimand	2 560
Grand	7 020
Lakeside Land	2 630
Total	12 210
Lake Ontario	
Oakville to Pickering	2 710
Welland, West Lincoln	460
Trent	2 900
Moira to Gananoque	-
Lakeside Land	3 210
Total	9 280
Total of above	48 600
Remainder of Province	9 530
Total Province	58 130

APPENDIX XV - Area Grown and Sprayed, and Quantities of Active Ingredients of Pesticides Used on Field Crops, Fruits, Vegetables, and Roadsides in Ontario, 1983

Crop	Area Grown	Area Sprayed	Herbicide: Triazine	Herbicide: Phenoxy	Herbicide: Other	Fungicide	Insecticide	Nematocides	Growth Regulators	Total	% of Total Pesticide
	- '000 ha -					- tonnes -					%
Corn	1 052.0	1 039.4	2 150.6	81.5	1 421.2	-	145.2	-	-	3 798.5	43.3
Soybeans	364.0	361.1	192.1	0.2	1 089.6	-	-	-	-	1 281.9	14.6
Dry Beans	32.0	31.5	0.6	-	56.8	1.1	1.3	-	-	59.8	0.7
Tobacco	40.5	40.5	-	-	17.8	-	39.9	1 610.6	590.8	2 259.1	25.7
Grain[a]	852.0	535.1	0.3	333.4	42.5	0.1	-	-	-	376.3	4.3
Hay & Pasture	1 720.0	32.7	-	15.1	9.6	-	0.2	-	-	24.9	0.3
Fruit	28.4	NA	2.0	0.1	5.8	411.0	143.8	-	-	562.7	6.4
Vegetables	72.9	NA	19.1	6.5	75.2	154.7	100.5	-	-	356.0	4.0
Roadsides	-	30.6	-	56.9	1.2	-	-	-	-	58.1	0.7
Total	4 161.8	NA	2 364.7	493.7	2 719.7	566.9	430.9	1 610.6	590.8	8 777.3	100.0
% in Category			26.9	5.6	31.0	6.5	4.9	18.4	6.7	100.0	

[a]Includes winter wheat, oats, barley and mixed grain. NA - Not Available

APPENDIX XVI - Quantities of Specific Pesticide Active Ingredients Used on All Field Crops, Fruits, Vegetables and Roadsides in Ontario, 1983

HERBICIDES	kilograms
2,4-D (p)	184 480
2,4-DB (p)	55 380
2,4-DP (p)	24 600
EPTC (o)	30 330
MCPA (p)	157 210
MCPB (p)	21 540
acifluorfen (o)	2 400
alachlor (o)	1 060 640
allidochlor (o)	19 160
amino triazole + ammonium thiocyanate (o)	880
atrazine (t)	1 729 680
bensulide (o)	1 360
bentazon (o)	29 750
bromoxynil (o)	7 080
butylate (o)	298 450
chloramben (o)	47 100
chlorbromuron (o)	510
chlorothal-methyl (o)	420
chloroxuron (o)	120
chlorpropham (o)	130
cyanazine (t)	43[illegible] 820
dalapon (o)	1 [illegible]90
dicamba (p)	45 130
dichlobenil (o)	340
diclofop-methyl (o)	1 380
difenzoquat (o)	2 910
dinoseb (o)	790
diphenamid (o)	14 470
diquat (o)	1 520
diuron (o)	2 200
fluazifop-butyl (o)	610
glyphosate (o)	76 350
ioxynil (o)	460
linuron (o)	152 090
mecoprop (p)	4 170
mefluidide (o)	20
metabromuron (o)	27 930
metolachlor (o)	842 640
metribuzin (t)	200 120
monolinuron (o)	4 340
napropamide (o)	250
naptalam (o)	1 780
paraquat (o)	2 020
pebulate (o)	3 040
prometryne (t)	120
propanil (o)	100
propyzamide (o)	70

HERBICIDES (cont'd)	kilograms
pyrazon (p)	1 240
sethoxydim (o)	4 430
simazine (t)	3 000
terbacil (o)	1 090
trifluralin (o)	79 340
Total	5 578 180
FUNGICIDES	
anilazine	120
benomyl	4 360
captafol	18 430
captan	104 260
chlorothalonil	58 090
dichlone	1 590
dichloran	750
dodine	6 440
ferbam	6 370
fixed copper	7 250
folpet	4 140
iprodione	890
mancozeb	111 410
maneb	22 070
metalaxyl	1 080
metiram	139 080
streptomycin sulfate	70
sulphur	79 340
thiophanate-methyl	20
thiram	540
zineb	590
Total	566 890
INSECTICIDES	
Bacillus thuringiensis	3 930
acephate	16 120
aldicarb	5 230
azinphos methyl	30 480
carbaryl	36 480
carbofuran	43 890
chinomethionat	1 070
chlordane	1 040
chlorfenvinphos	80
chlorpyrifos	29 250
cyhexatin	7 810
cypermethrin	820
deltamethrin	90
demeton	1 290

INSECTICIDES (cont'd)	kilograms
diazinon	13 990
dicofol	6 320
dimethoate	1 610
dinocap	7 160
disulfoton	10 640
endosulfan	9 160
fenbutatin oxide	150
fensulfothion	500
fenvalerate	1 710
fonofos	40 130
formetanate hydrochloride	1 010
isofenphos	2 710
lindane	110
malathion	6 190
methamidophos	2 410
methidathion	430
methomyl	2 640
methoxychlor	2 570
mevinphos	280
naled	380
oxydemeton-methyl	2 550
parathion	3 590
permethrin	1 720
phorate	5 350
phosalone	16 430
phosmet	36 920
pirimicarb	180
propargite	1 750
terbufos	72 340
trichlorfon	2 360
Total	430 870
NEMATOCIDES	
chloropicrin	73 970
dazomet	200
dichloropropenes + dichloropropanes	1 350 380
metam-sodium	260
methylisothiocyanate	185 800
Total	1 610 610
GROWTH REGULATORS	
decyl alcohol	590 270
ethephon	550
Total	590 820

(t) - triazine herbicide, (p) - phenoxy herbicide, (o) - other herbicide

APPENDIX XVII - Quantities of Active Ingredients of Each Type of Pesticide Used on All Field Crops, Fruits, Vegetables, and Roadsides, by County and District, Ontario, 1983

Counties	Herbicides			Fungicides[a]	Insecticides	Nematocides	Growth Regulators
	Triazine	Phenoxy	Other				
				- kilograms -			
Brant	50 090	7 220	93 580	9 270	13 150	406 310	24 410
Elgin	84 240	13 940	196 470	10 730	13 360	179 470	52 700
Essex	58 870	7 540	200 900	58 580	20 510	5 180	920
Haldimand-Norfolk	84 280	32 480	136 490	36 270	36 560	736 030	403 290
Hamilton-Wentworth	26 210	9 270	29 260	28 500	19 450	-	-
Kent	205 780	16 240	364 660	35 020	25 180	12 100	2 160
Lambton	193 220	25 750	267 570	11 550	11 530	-	-
Middlesex	243 650	24 490	256 610	11 500	38 340	93 810	46 620
Niagara	60 790	1 880	49 520	174 040	61 150	-	-
Oxford	131 020	35 410	144 040	8 020	41 880	140 480	51 620
Southern Ontario	**1 138 150**	**174 220**	**1 739 100**	**383 480**	**281 110**	**1 573 380**	**581 720**
Bruce	131 630	32 580	30 150	580	3 600	-	-
Dufferin	8 730	7 500	2 830	5 720	4 070	-	-
Grey	21 760	19 140	7 910	36 760	12 870	-	-
Halton	7 480	3 030	370	7 180	2 840	-	-
Huron	230 970	35 750	277 700	3 490	18 070	-	-
Peel	21 620	4 240	34 930	9 280	3 660	-	-
Perth	201 080	30 190	80 090	790	20 690	-	-
Simcoe	57 050	14 900	110 910	30 990	19 800	-	-
Waterloo	62 000	13 000	57 860	3 790	15 290	-	-
Wellington	61 620	24 870	24 560	2 700	4 600	-	-
Western Ontario	**803 940**	**185 200**	**627 310**	**101 280**	**105 490**	**-**	**-**
Durham	79 040	12 960	42 880	16 920	8 720	14 890	3 640
Haliburton	-	-	-	-	-	-	-
Hastings	18 260	6 090	20 640	1 860	1 280	-	-
Muskoka	10	50	50	90	70	-	-
Northumberland	46 480	8 920	26 440	20 390	9 530	22 340	5 460
Parry Sound	10	170	40	120	90	-	-
Peterborough	17 900	5 910	11 410	1 290	2 490	-	-
Prince Edward	19 550	2 980	38 220	12 060	6 240	-	-
Victoria	22 990	6 730	32 660	700	550	-	-
York	41 320	12 970	38 260	13 890	7 880	-	-
Central Ontario	**245 560**	**56 780**	**210 600**	**67 320**	**36 850**	**37 230**	**9 100**
Dundas	20 130	4 880	15 600	1 620	610	-	-
Frontenac	3 480	7 070	5 000	480	220	-	-
Glengarry	25 950	6 120	19 010	530	270	-	-
Grenville	7 600	2 200	2 720	1 180	490	-	-
Lanark	16 510	4 940	13 180	210	160	-	-
Leeds	8 810	1 350	6 160	950	470	-	-
Lennox & Addington	11 650	2 340	24 470	500	360	-	-
Ottawa-Carleton	35 910	5 130	17 220	2 920	1 460	-	-
Prescott	9 060	6 240	7 420	1 200	840	-	-
Renfrew	9 010	5 570	1 800	1 080	470	-	-
Russell	12 220	16 280	5 980	300	240	-	-
Stormont	16 610	4 760	18 960	70	40	-	-
Eastern Ontario	**176 940**	**66 880**	**137 520**	**11 040**	**5 630**	**-**	**-**
Algoma	30	800	1 500	210	170	-	-
Cochrane	20	-	120	330	250	-	-
Kenora	-	-	10	10	10	-	-
Manitoulin	10	-	50	220	120	-	-
Nipissing	10	600	50	100	90	-	-
Rainy River	-	1 520	20	130	60	-	-
Sudbury	40	650	280	730	520	-	-
Thunder Bay	30	10	240	670	470	-	-
Timiskaming	10	7 090	2 890	190	100	-	-
Northern Ontario	**150**	**10 670**	**5 160**	**2 590**	**1 790**	**-**	**-**
Province	**2 364 740**	**493 750**	**2 719 690**	**565 710**	**430 870**	**1 610 610**	**590 820**

[a]Includes fungicides used on fruit and vegetable crops only.

APPENDIX XVIII - Quantities of Active Ingredients of Each Type of Pesticide Used on Field Crops, Fruits, Vegetables, and Roadsides in the Various Ontario Drainage Basins of the Great Lakes, 1983

Drainage Basins	Herbicides			Fungicides[a]	Insecticides	Nematocides	Growth Regulators	Total
	Triazine	Phenoxy	Other					
	- kilograms -							
LAKE HURON & GEORGIAN BAY								
Ausable, Bayfield, Maitland	309 340	52 390	283 410	5 040	19 510	-	-	669 690
Saugeen	129 610	34 940	29 060	900	2 460	-	-	196 970
Nottawasaga to Owen Sound	45 910	19 440	39 970	60 850	28 430	-	-	194 600
Holland, Severn	25 580	13 280	35 170	16 470	9 490	-	-	99 990
Lakeside Land	102 950	23 720	212 940	12 370	14 250	-	-	366 230
Total	613 390	143 770	600 550	95 630	74 140	-	-	1 527 480
LAKE ST. CLAIR								
Thames	568 440	73 630	635 580	40 040	93 370	127 250	58 990	1 597 300
Sydenham	176 750	21 730	207 260	2 260	7 370	-	-	415 370
Lakeside Land	20 600	3 220	51 040	3 220	2 710	-	-	80 790
Total	765 790	98 580	893 880	45 520	103 450	127 250	58 990	2 093 460
LAKE ERIE								
Kettle to Haldimand	127 900	47 520	282 940	47 720	58 770	994 600	491 340	2 050 790
Grand	200 280	50 960	217 380	20 390	43 650	448 580	31 390	1 012 630
Lakeside Land	164 690	11 770	298 820	64 900	24 950	2 950	-	3 631 500
Total	492 870	110 250	799 140	133 010	127 370	1 446 130	522 730	6 694 920
LAKE ONTARIO								
Oakville to Pickering	80 970	14 410	65 690	23 570	10 920	-	-	195 560
Welland, West Lincoln	22 240	2 850	24 340	111 330	37 950	-	-	198 710
Trent	129 550	22 090	92 360	22 550	13 180	-	-	279 730
Moira to Gananoque	18 570	10 130	42 880	930	630	-	-	73 140
Lakeside Land	79 310	21 840	87 470	116 760	54 990	37 230	9 100	406 700
Total	330 640	71 320	312 740	275 140	117 670	37 230	9 100	1 153 840
Total of Above	2 202 690	423 920	2 606 310	549 300	422 630	1 610 610	590 820	8 406 280
Remainder of Province	162 050	69 830	113 380	16 410	8 240	-	-	369 910
Total Province	2 364 740	493 750	2 719 690	565 710	430 870	1 610 610	590 820	8 776 190

[a]Includes fungicides used on fruit and vegetable crops only.

APPENDIX XIX - List of Common (Chemical) and Trade Names

Common Name	Other Names
2,4-D	Amsol, Brushkill, Esteline
2,4-DB	Embutox E, Combutox, 2,4-D Butyric
Bacillus thuringiensis	Thuricide, Dipel
EPTC	Eptam, Eradicane
MCPA	Methoxone, MCPA-Amine, MCPA-Sodium Salt
MCPB	Tropotox
acephate	Orthene
acifluorfen	Blazer
alachlor	Lasso, Lasso II
aldicarb	Temik
allidochlor	Randox
amino triazole + ammonium thiocyanate	Amitrole, Amitrol-T, Cytrol
anilazine	Dyrene
atrazine	AAtrex, AAtrex-Nine-O, AAtrex-Plus
azinphos-methyl	Guthion, APM
benomyl	Benlate
bensulide	Betasan, Prefar, Pre-San
bentazon	Basagran
bromoxynil	Pardner, Torch
butylate	Sutan, Sutan+
captafol	Difolatan
captan	Orthocide, Captan
carbaryl	Sevin
carbofuran	Furadan
chinomethionat	Morestan
chloramben	Amiben, No-Hoe
chlorbromuron	Maloran
chlordane	Chlordane
chlorfenvinphos	Birlane
chlorothal-methyl	Dacthal, DCPA
chlorothalonil	Bravo, Daconil
chloroxuron	Tenoran
chlorpropham	CIPC
chlorpyrifos	Lorsban, Dursban
cyanazine	Bladex
cyhexatin	Plictran
cypermethrin	Cymbush, Ripcord
dalapon	Dowpon M, Basfapon, Dalapon
dazomet	Basamid
decyl alcohol	Antak, Chiptac, Contak, Delete, Emtrol, Emtrol-Ten, Fair-Tac, Pflzol, Royaltac
deltamethrin	Decis
demeton	Systox
diazinon	Basudin, Diazinon
dicamba	Banvel, Dycleer
dichlobenil	Casoron
dichlone	Phygon
dichloran	Botran
diclofop-methyl	Hoe-Grass
dicofol	Kelthane
difenzoquat	Avenge
dimethoate	Cygon
dinocap	Karathane
dinoseb	Amine Dinitro, Dinitro, Premerge, Sinox, Topper, Dytop
diphenamid	Enide
diquat	Reglone
disulfoton	Di-Syston
diuron	Karmex
dodine	Cyprex
endosulfan	Thiodan
ethephon	Ethrel
fenbutatin oxide	Torque
fensulfothion	Dasinit
fenvalerate	Belmark
ferbam	Formate, Ferbam
fixed copper	Basi-Cop, Spray-Cop, Tri-Cop, Kocide
fluazifop-butyl	Fusilade
folpet	Phaltan
fonofos	Dyfonate
formetanate hydrochloride	Carzol
glyphosate	Roundup
loxynil	Totril
iprodione	Rovral
isofenphos	Amaze
lindane	Lindane
linuron	Lorox, Afolan
malathion	Cythion, Malathion
mancozeb	Dithane M45, Manzate 200
maneb	Dithane M22, Manzate D, Mantox
mecoprop	MCPP, Mecoturf, Compitox
mefluidide	Embark
metalaxyl	Ridomil
metam-sodium	Vapam, VPM
methamidophos	Monitor
methidathion	Supracide
methomyl	Lannate
methoxychlor	Marlate
metiram	Polyram
metobromuron	Patoran
metolachlor	Dual
metribuzin	Sencor, Lexone
mevinphos	Phosdrin
monolinuron	Afesin
naled	Dibrom
napropamide	Devrinol
naptalam	Alanap
oxydemeton-methyl	Meta-Systox-R
paraquat	Gramoxone
parathion	Parathion
pebulate	Tillam
permethrin	Ambush, Pounce
phorate	Thimet
phosalone	Zolone
phosmet	Imidan
pirimicarb	Pirimor
prometryne	Gesagard
propargite	Omite
propyzamide	Kerb
pyrazon	Pyramin
sethoxydim	Poast
simazine	Princep, Princep-Nine-T, Simmaprim, Simadex
streptomycin sulfate	Agristrep, Agri-Mycin-17
sulphur	Sulphur
terbacil	Sinbar
terbufos	Counter
thiophanate-methyl	Easout
thiram	Arasan
trichlorfon	Dylox
trifluralin	Treflan
zineb	Thiogreen, Dithane Z-78

Mixtures

2,4-D + 2,4-DP	Silvaprop
2,4-D + mecoprop + dicamba	Killex, Kil-Mor
DCP + MIS	Vorlex
DCP + chloropicrin	Telone C-17
DCP + chloropicrin + MIS	Vorlex CP
MCPA + MCPB	Tropotox Plus
atrazine + simazine	Ekko, Eramox
bentazon + atrazine	Laddok
bromoxynil + MCPA	Bromox, Buctril, Sabre
chloramben + linuron	Amlon
cyanazine + MCPA	Blagal
cyanazine + atrazine	Blazine
dicamba + MCPA	Dyvel
metolachlor + atrazine	Prim Extra
propanil + MCPA	Stampede

Note: DCP - 1,3 dichloropropene + 1,2 dichloropropane MIS - methylisothiocynate

FIGURE 2:

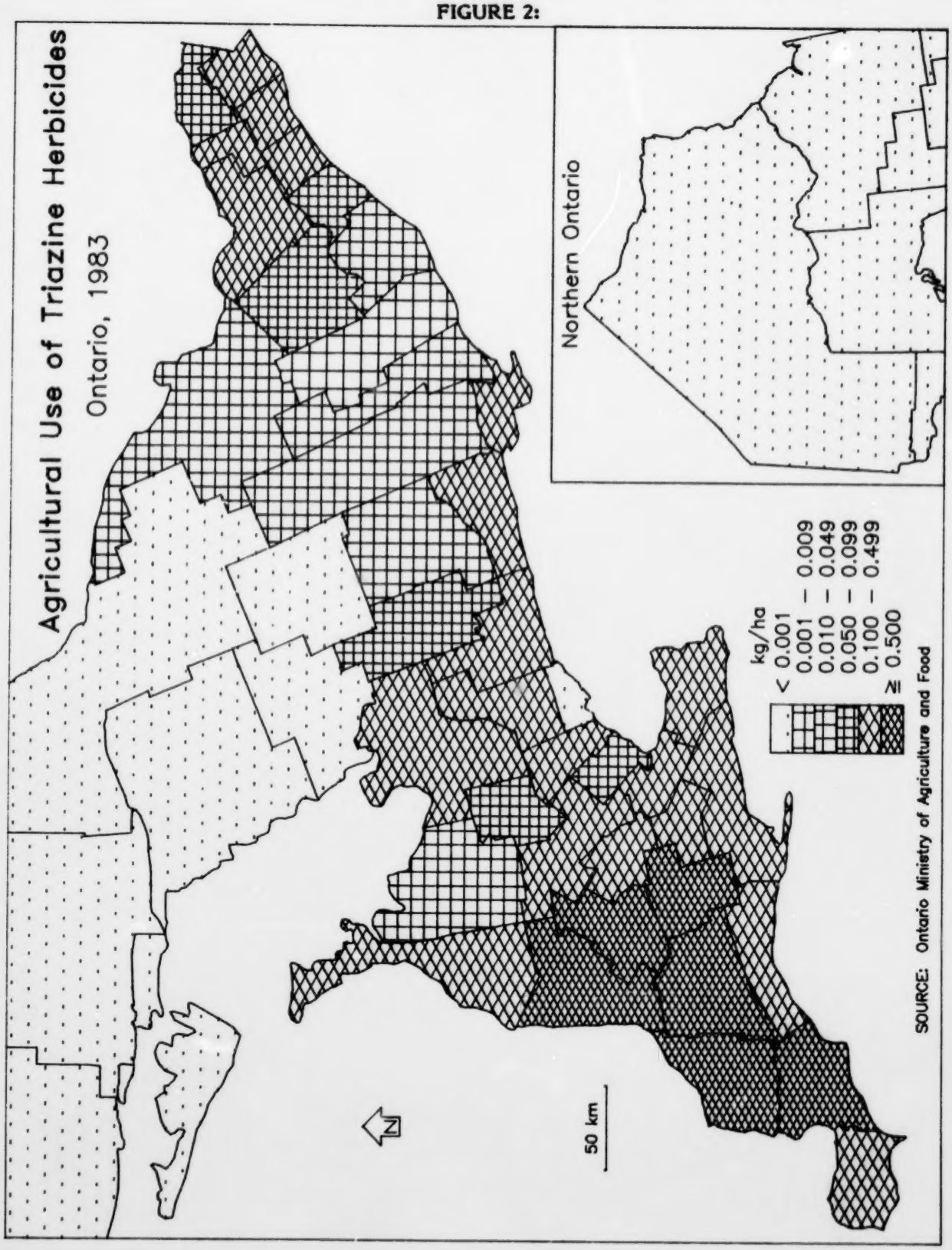
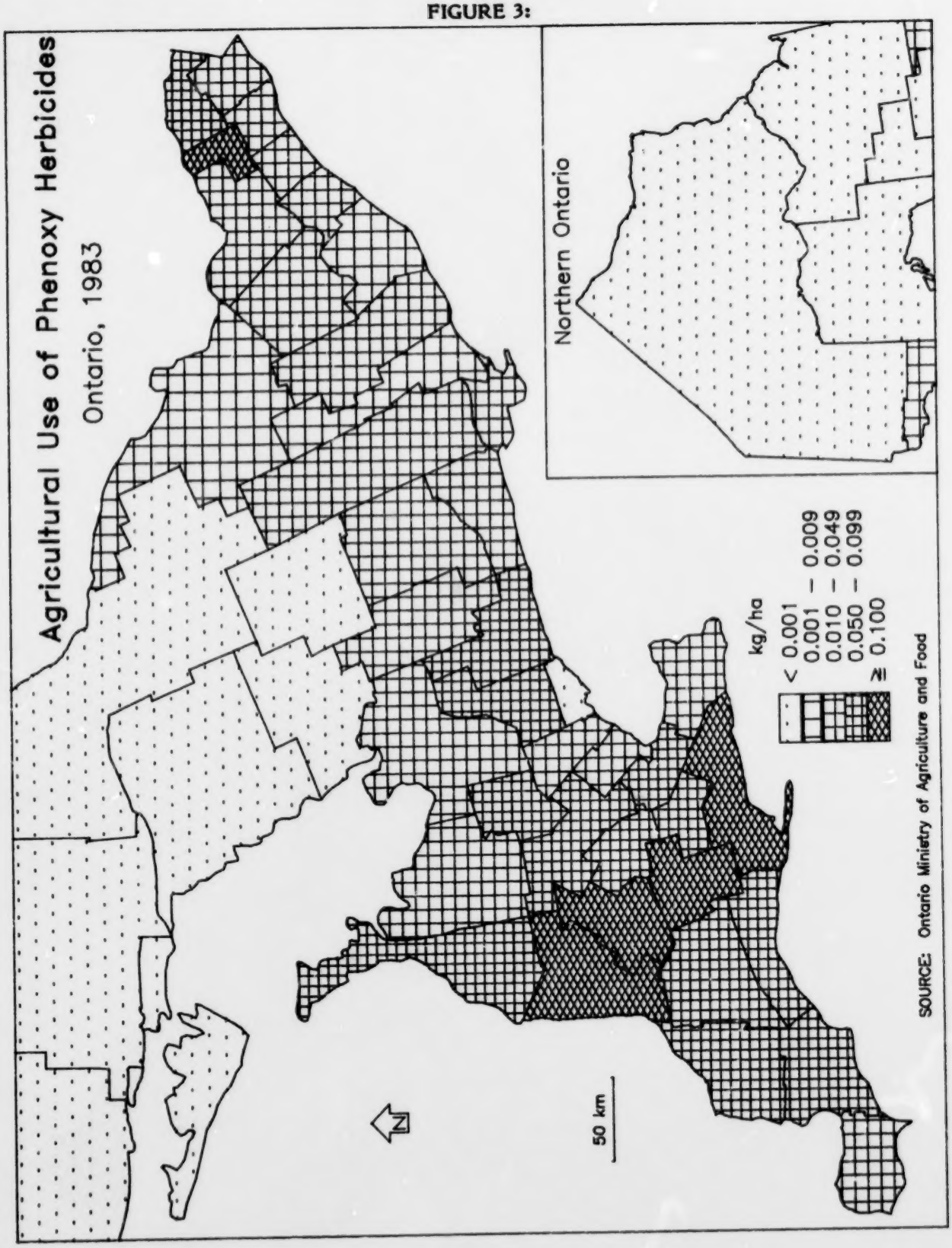

Agricultural Use of Triazine Herbicides
Ontario, 1983
Northern Ontario
kg/ha
< 0.001
0.001 – 0.009
0.010 – 0.049
0.050 – 0.099
0.100 – 0.499
≥ 0.500
N
50 km
SOURCE: Ontario Ministry of Agriculture and Food

FIGURE 3:


Agricultural Use of Phenoxy Herbicides
Ontario, 1983
Northern Ontario
kg/ha
< 0.001
0.001 – 0.009
0.010 – 0.049
0.050 – 0.099
≥ 0.100
50 km
N
SOURCE: Ontario Ministry of Agriculture and Food

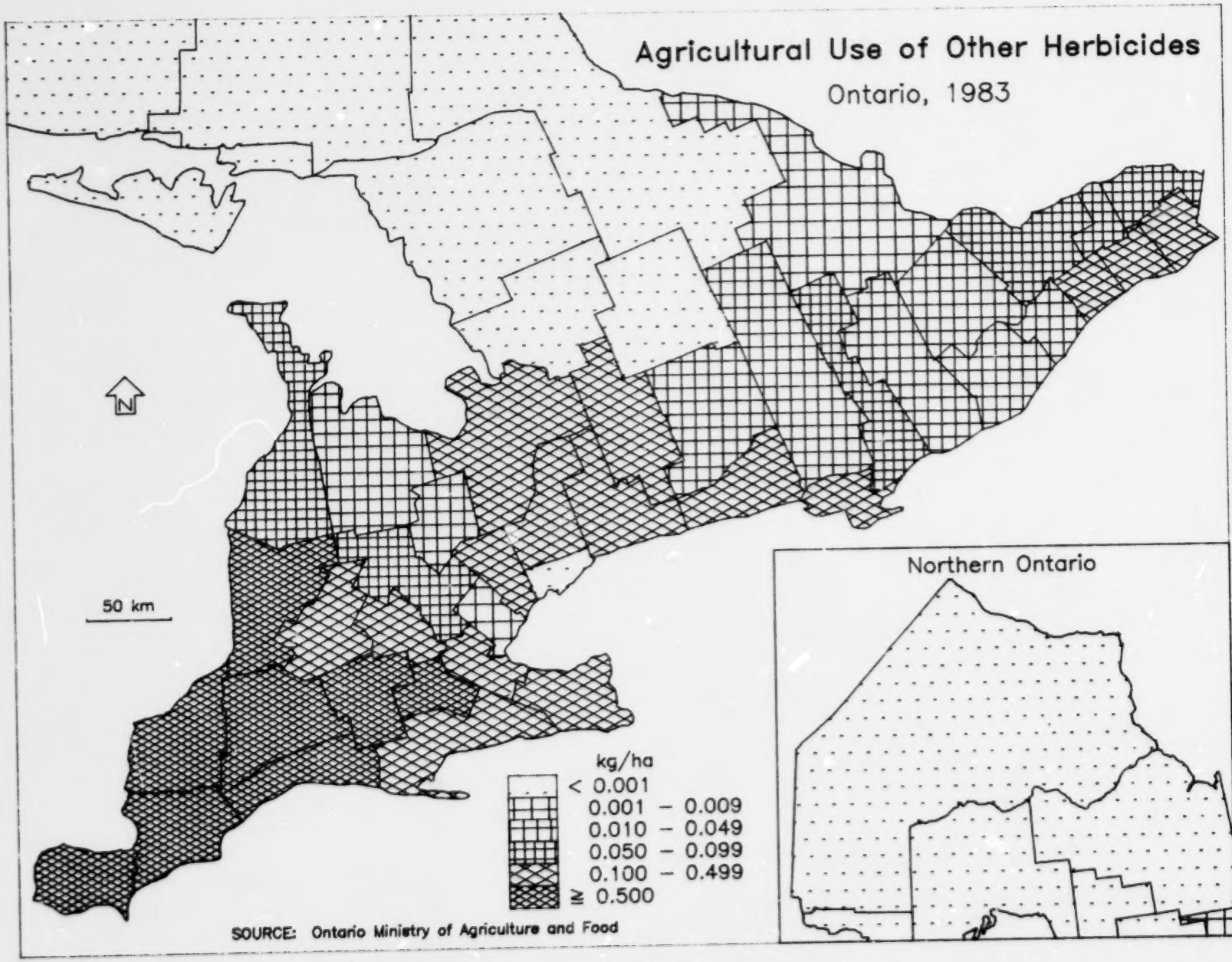

Agricultural Use of Other Herbicides
Ontario, 1983
N
50 km
kg/ha
< 0.001
0.001 – 0.009
0.010 – 0.049
0.050 – 0.099
0.100 – 0.499
≥ 0.500
Northern Ontario
SOURCE: Ontario Ministry of Agriculture and Food

FIGURE 4:

FIGURE 5:

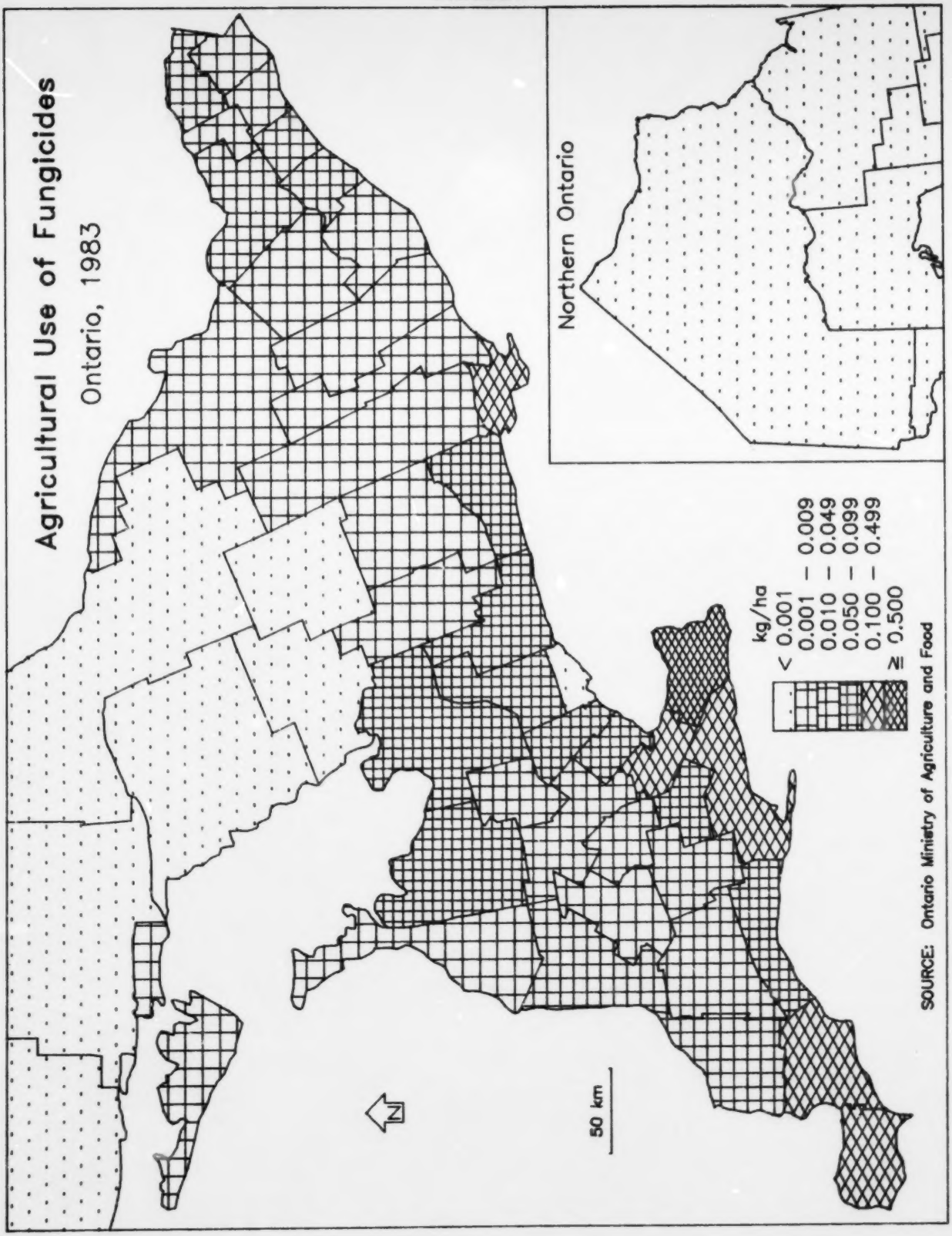
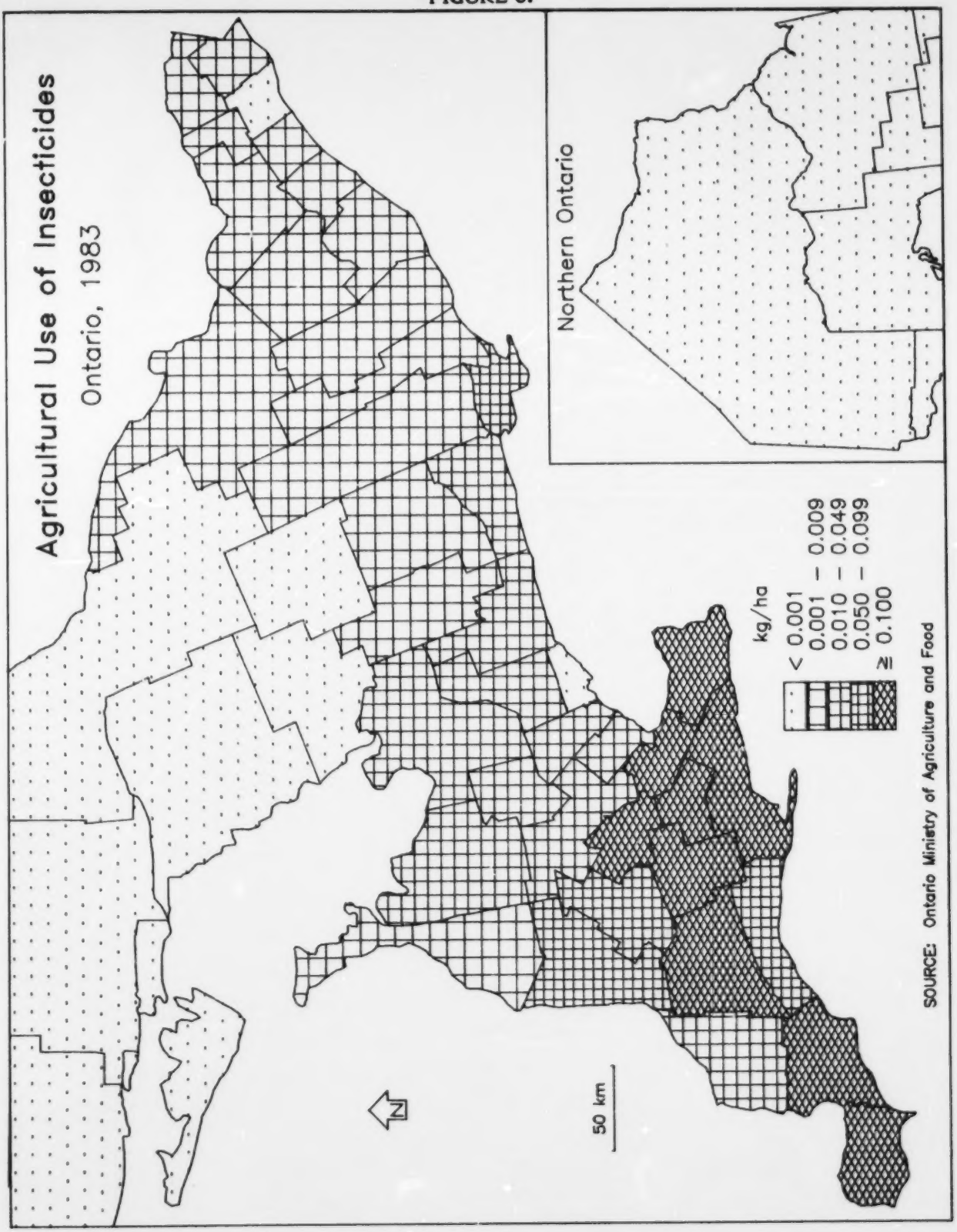

Agricultural Use of Fungicides
Ontario, 1983
Northern Ontario
kg/ha
< 0.001
0.001 – 0.009
0.010 – 0.049
0.050 – 0.099
0.100 – 0.499
≥ 0.500
50 km
N
SOURCE: Ontario Ministry of Agriculture and Food

FIGURE 6:


Agricultural Use of Insecticides
Ontario, 1983
Northern Ontario
kg/ha
< 0.001
0.001 – 0.009
0.010 – 0.049
0.050 – 0.099
≥ 0.100
50 km
N
SOURCE: Ontario Ministry of Agriculture and Food

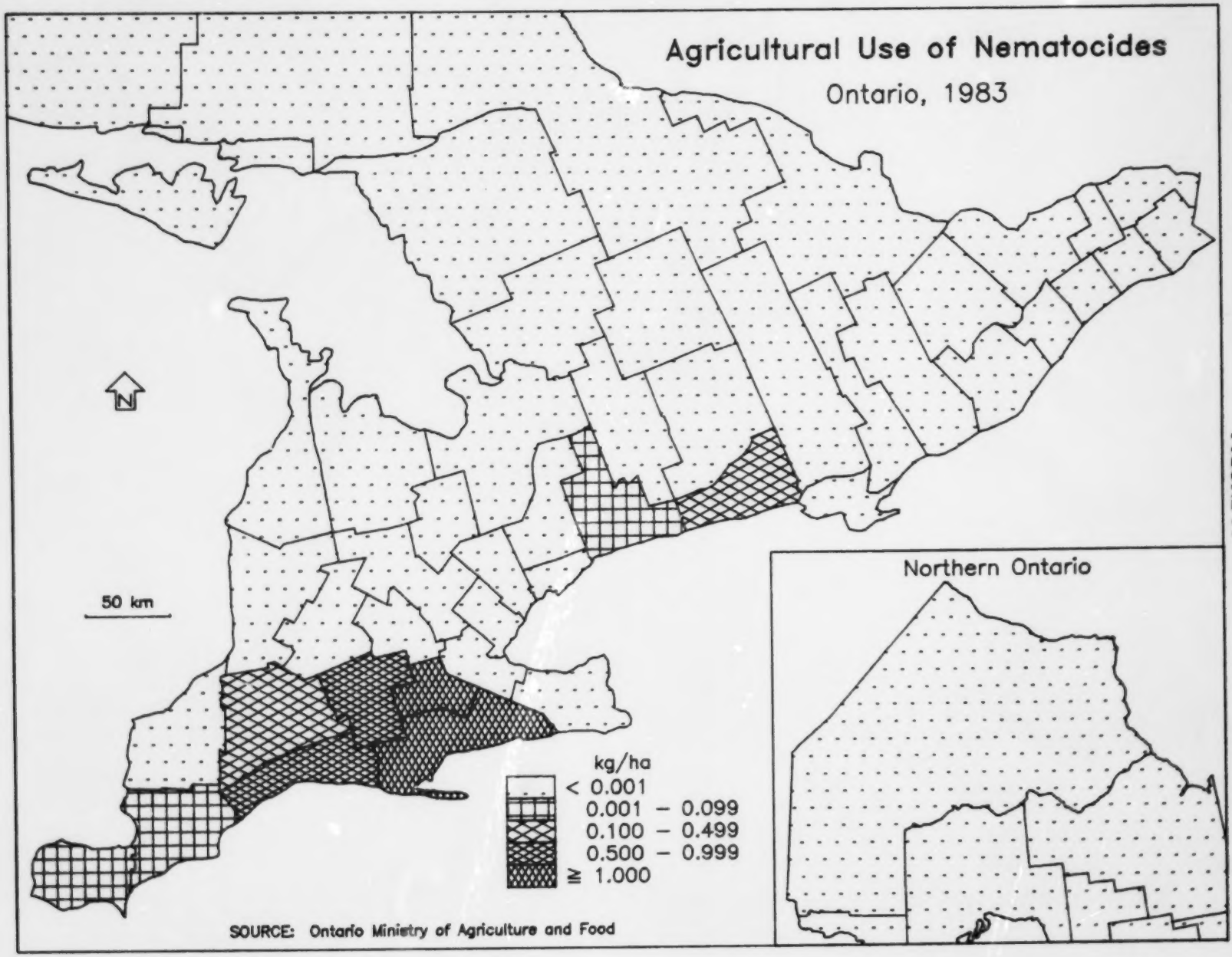

Agricultural Use of Nematocides
Ontario, 1983
N
50 km
kg/ha
< 0.001
0.001 – 0.099
0.100 – 0.499
0.500 – 0.999
≧ 1.000
SOURCE: Ontario Ministry of Agriculture and Food
Northern Ontario

FIGURE 7:

FIGURE 8:

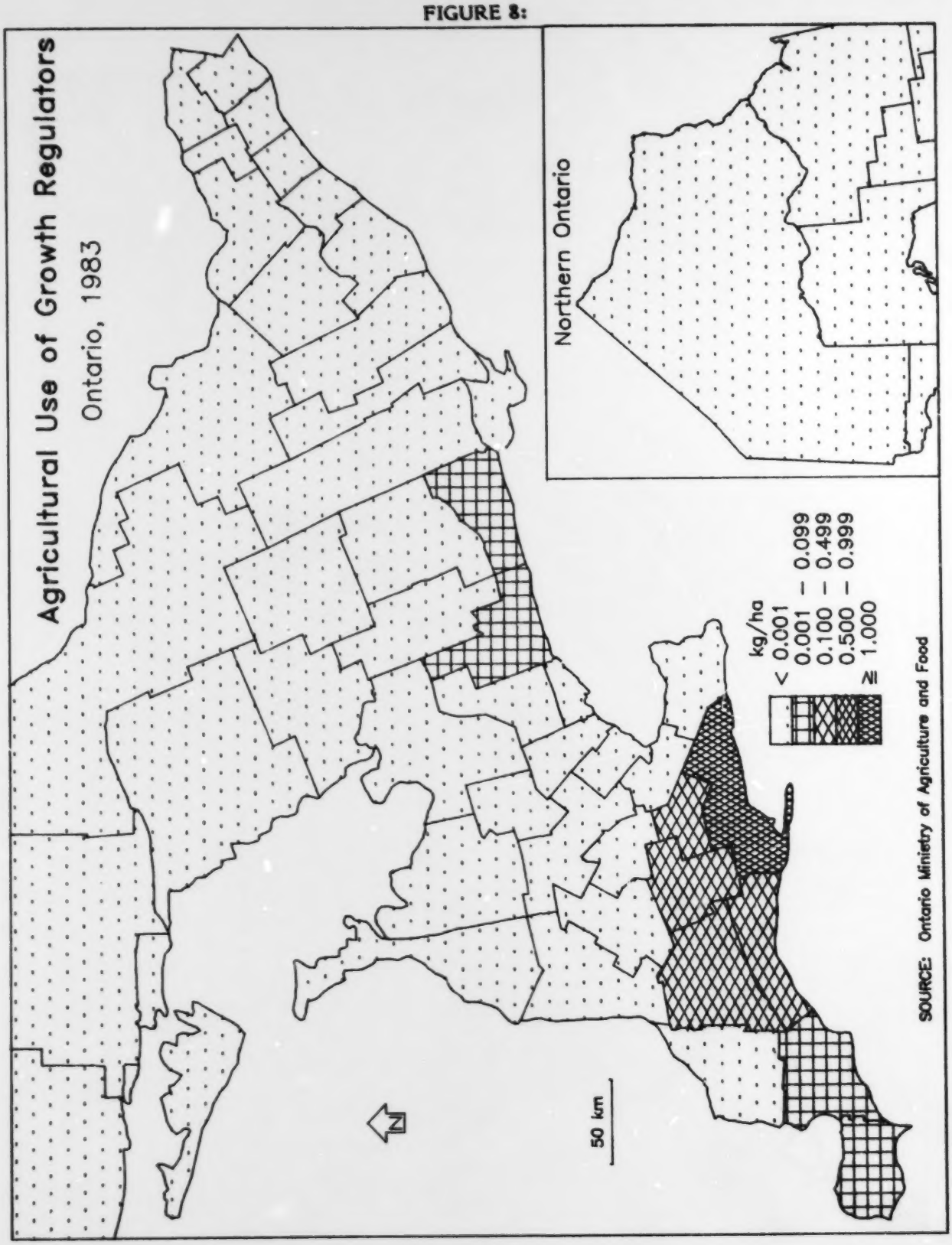
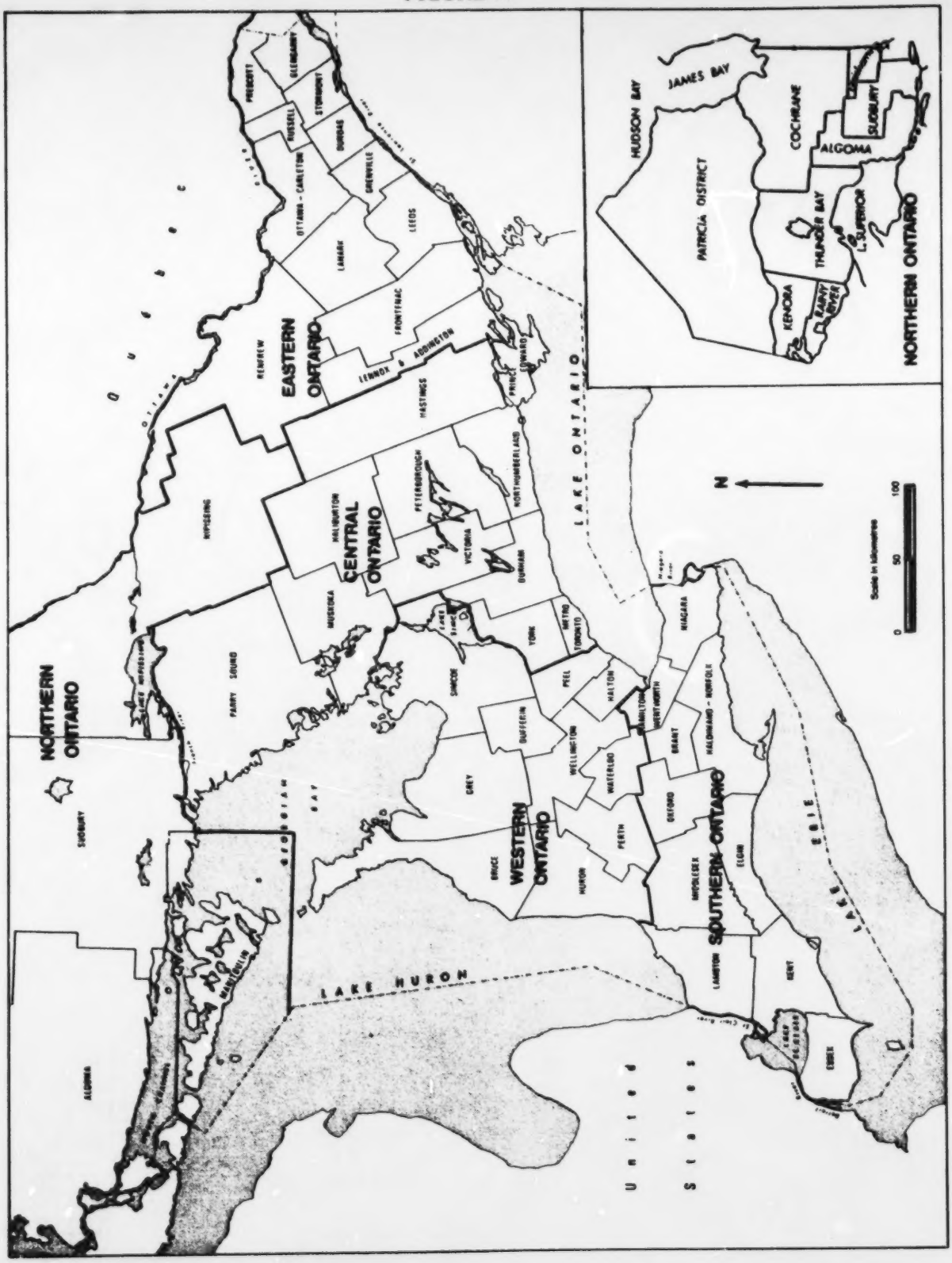

Agricultural Use of Growth Regulators
Ontario, 1983
Northern Ontario
kg/ha
< 0.001
0.001 – 0.099
0.100 – 0.499
0.500 – 0.999
≥ 1.000
50 km
N
SOURCE: Ontario Ministry of Agriculture and Food

FIGURE 9:


NORTHERN ONTARIO
EASTERN ONTARIO
CENTRAL ONTARIO
WESTERN ONTARIO
SOUTHERN ONTARIO
LAKE ONTARIO
LAKE HURON
LAKE ERIE
GEORGIAN BAY
United States
HUDSON BAY
JAMES BAY
PATRICIA DISTRICT
COCHRANE
ALGOMA
THUNDER BAY
L. SUPERIOR
SUDBURY
KENORA
RAINY RIVER
NORTHERN ONTARIO
N
Scale in kilometres
0
50
100
RENFREW
PRESCOTT
RUSSELL
GLENGARRY
STORMONT
OTTAWA - CARLETON
DUNDAS
GRENVILLE
LANARK
LEEDS
FRONTENAC
LENNOX & ADDINGTON
HASTINGS
PRINCE EDWARD
NIPISSING
HALIBURTON
PETERBOROUGH
NORTHUMBERLAND
PARRY SOUND
MUSKOKA
VICTORIA
DURHAM
SIMCOE
YORK
METRO TORONTO
PEEL
HALTON
NIAGARA
DUFFERIN
WELLINGTON
HAMILTON WENTWORTH
BRANT
HALDIMAND - NORFOLK
GREY
WATERLOO
OXFORD
BRUCE
PERTH
HURON
MIDDLESEX
ELGIN
LAMBTON
KENT
ESSEX

REFERENCES

[1] Ontario Ministry of Agriculture and Food. Agricultural Statistics for Ontario, 1983. Publication 20. Toronto.

[2] _____. Economics Branch. Seasonal Fruit and Vegetable Report, Annual Summary, 1982. Toronto.

[3] _____. 1983 Fruit Production Recommendations. Publication 360. Toronto.

[4] _____. 1983 Vegetable Production Recommendations. Publication 363. Toronto.

[5] Roller, N.F. Survey of Pesticide Use in Ontario, 1973. Economics Information. Toronto: Economics Branch, Ontario Ministry of Agriculture and Food, 1975.

[6] Roller, N.F. Survey of Pesticide Use in Ontario, 1978. Economics Information. Toronto: Economics Branch, Ontario Ministry of Agriculture and Food, 1979.

[7] Statistics Canada. 1981 Census of Agriculture, Ontario. Catalogue No. 96-907. Ottawa.

RECENT PUBLICATIONS FROM THE ECONOMICS AND POLICY COORDINATION BRANCH OF THE ONTARIO MINISTRY OF AGRICULTURE AND FOOD

Agricultural Statistics for Ontario, 1983, by Statistics Section.

The Economics of Soybean Production in Ontario, 1980, by G.A. Fisher. Economics Information, Dec. 1981.

The Impact of Metric Conversion of Packaging on Fluid Milk Consumption: A Case Study of the Thunder Bay Market, by T. Crozier. Economic Research, Feb. 1982.

The Economics of Producing Flue-Cured Tobacco in Ontario, by G.A. Fisher. Economics Information, Jan. 1983.

Estimated Cost of Growing Potatoes, 1982; and Projections for 1983, by B. Campbell. Economics Information, Jan. 1983.

Potato Packing and Storage Costs 1981-82 Crop Year, by B. Campbell. Economics Information, Jan. 1983.

Estimated Cost of Growing White Beans, 1982, by B. Campbell. Economics Information, May 1983.

Apple Production Costs for Standard and Size-Controlling Trees, Ontario, 1982, by E.D. McKibbon. Economics Information, July 1983.

Beef Feedlot Cost Study, Southern and Western Ontario, 1982, by F.R. Abraham. Economics Information, July 1983.

Economics of Fresh-Market Tomato, Cabbage, and Cauliflower Production in Ontario, 1982, by G.A. Fisher. Economics Information, Aug. 1983.

Farm Rental Arrangements in Ontario, 1982, by G.A. Fisher. Economics Information, Sept. 1983.

A Survey of Custom Farmwork Rates Charged in Ontario, 1983, by G.A. Fisher. Economics Information, Jan. 1984.

Strawberry Production Costs in Ontario, by Dirk Buth and Errol McKibbon. Economics Information, Rept. No. 84-03, Mar. 1984.

A Computer Program for Generating Crop Enterprise Budgets, by Gary Lentz and Blair Campbell. Economics Information Rept. No. 84-04, Sept. 1984.

Single copies of the above publications are available on request from the Economics and Policy Coordination Branch, Ontario Ministry of Agriculture and Food, Legislative Buildings, Queen's Park, Toronto, Ontario M7A 1B6.

ISBN 0-7743-9959-7 84-12-13 1.5M